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A [illegible]L REVISION OF THE GENUS EUCALYPTUS

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

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PART LXI OF THE COMPLETE WORK.

(WITH FOUR PLATES.)

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A Critical Revision of the Genus Eucalyptus

BY

J. H. MAIDEN, I.S.O., F.R.S., F.L.S.

(Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney).

Vol. VII. Part 1.

Part LXI of the Complete Work.

(WITH FOUR PLATES.)

"Ages are spent in collecting materials, ages more in separating and combining them. Even when a system has been formed, there is still something to add, to alter, or to reject. Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augmented by fresh acquisitions, to future ages. In these pursuits, therefore, the first speculators lie under great disadvantages, and even when they fail, are entitled to praise."

MACAULAY'S "ESSAY ON MILTON."

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DESCRIPTION.

CCCLII. E. fastigata Deane and Maiden.

In *Proc. Linn. Soc. N.S.W.*, xxx, 809, with Plate lxi (1896).

See also Part VII, p. 185, of the present work, where the description is printed, and where the species is looked upon as a form of *E. regnans* F.v.M., but not described as a variety. At the same time, some specimens have been issued from the National Herbarium, Sydney, under the name of *E. regnans* var. *fastigata*, in the ordinary way of exchange.

I for a long time looked upon *E. fastigata* as an environmental form of *E. regnans*, but after further travel and examination of specimens, and consultation with other botanists, I have come to the conclusion that they are distinct species. See "Affinities."

Mr. Harry Hopkins, speaking of the jungle near Bendoc, north-eastern Gippsland, says this species has leaves the thinnest, most translucent and of the palest green that he has found in the district. The leaves of both it and *E. regnans* are always thin.

Illustrations.—It seems to have been sufficiently figured in Part VII, Plate 33, as follows:—Figures 3, 6, 6a (exceptionally flat-topped), 7, 8, 9. In addition, the buds 1b, and the fruits 1c, belong to *E. fastigata*. They were collected at Monga, near Braidwood (W. Baeuerlen), but were in error cited as from the Dandenong, Victoria, where Figs. 1 and 1a, type of *E. regnans*, came from. All the rest of the figures on this Plate belong to *E. regnans*, and it will be observed that while (see below) a general character of the fruit of *E. fastigata* is domedness, in comparison with the truncateness of that of *E. regnans*, specimens occasionally occur which render this differentiation exceedingly difficult.

RANGE.

It is a tree of comparatively cool, mountain localities, and appears to be confined to eastern Gippsland (Victoria) and to the tablelands of New South Wales. The type comes from Tantawanglo Mountain, near Cathcart, Bombala district, N.S.W.

The following localities may be added to those given in Part VII, p. 187.

Victoria.

I cannot do better than cite the remarks of Mr. Harry Hopkins of Bairnsdale, a careful student of the genus :—

It is known as "Cut-tail." I have found it in some of the jungle gullies between the Bemm River and the Cann River in East Gippsland, also in the jungles on the north-east side of the Drummer Range where the Orbost-Genoa road crosses the range. It occurs only, so far as I know, on the red-coloured jungle soils (which I think are probably of volcanic origin). This is very noticeable at the Drummer Range, where, as soon as the red clayey jungle soil is left and the granitic formation entered upon, it ceases altogether. I noted the same thing at Bendoc, and other places. *E. obliqua* grows freely in these localities on the poorer granitic soils, and overflows on the "jungle soil" country, but *E. fastigata* never crosses the border line between the two soils.

New South Wales.

Southern Localities.—"Stem up to first branches covered with thick fibrous bark, like *E. eugenioides*, branches quite smooth, clean and almost white, like the branches of a very clean Gum." Half way up the cutting, Big Jack Mountain, Eden-Bombala Road (H. Hopkins). "Woolly Butt, a large tree, something like *E. gigantea* in appearance, shows a rough stringy bark, but cleans at the limbs. Timber in good demand for milling." Parker's Gap, Parish of Ollabulla, between Queanbeyan and Braidwood (W. A. W. de Beuzeville, No. 1). "White Top. Very like No. 1, but has a comparatively smooth bark, more like a Messmate, but cleans up well at the large limbs. A large tree. Timber in demand for sawmill work." Parker's Gap (W.A.W. de Beuzeville, No. 2). "Broad-leaf Messmate. A large Messmate-looking tree, esteemed for milling." Parker's Gap (W. A. W. de Beuzeville, No. 3). State Forest No. 577, Tallaganda, Braidwood district (C. J. Weston, No. 55). Clyde Mountain, near Nelligen (J. L. Boorman). Fibrous bark to branches, Nelligen Road, 6 miles from Braidwood (R. H. Cambage, No. 2067). "White Top Messmate," Fern Gully, Reidsdale-Braidwood district (F. W. Wakefield, No. 20). "Tree of 60 feet, 2 feet in diameter. Bark persistent to the uppermost branches and fibrous." Reidsdale (F. W. Wakefield, No. 26). Currockbilly, Wog Wog district (J. L. Boorman). Close to summit of Mount Dromedary (Forest Guard William Dunn, No. 139). "Called 'Silver Top' on Tantawanglo Mountain at Montgomery's Mill. Also 'Cut Tail' in Coast Range. (Both names used by timber inspector of Railway Construction Department.) 'Brown Barrel.'" Rossi, near Bungendore (Forest Guard Boyd). "Affinity to a Messmate. Large tree on the red soil near Robertson." (Forest Guard W. Dunn, No. 50).

Western Localities.—"Tall tree of the Stringybark character." Marrangaroo (Dr. E. C. Chisholm). "Top of Mount Werong, 30 miles south of Oberon, basalt formation, 3,900 feet above sea-level." (R. H. Cambage, No. 2257). Jenolan Caves-Oberon Road (F. W. Wakefield, No. 20). "Blackbutt, 80 feet, bark at butt of a blackish colour, varying to a reddish brown, extending to the branches."—Oberon (Assistant Forester H. W. Garling). "Blackbutt, one tree measured 83 feet to the

first limb, others measured from 50 to 60 feet. Considered a useful timber. Grows in deep gullies in the mountains." Forest Reserve 43,276, Parish Turon, County of Roxburgh (District Forester A. R. Samuels).

Northern Locality.—" Stringybark, has a rough bark on the barrel, with smooth limbs." On the Tomalla Tablelands, Hunter River Watershed (H. L. White, of Belltrees).

AFFINITIES.

1. With *E. regnans* F.v.M.

This is the species to which it is closest allied, and I will contrast both species under the headings of Bark and Fruits, the most obvious characters. (I may remark that there are some differences in the seedlings, but this is not the proper place to go into particulars.)

Bark (*E. regnans*).—The following detailed description is from the pen of Mr. Harry Hopkins, and will appeal to everyone who has travelled amongst the Big Trees of Victoria.

The amount of variation in the bark, so far as I know it in Gippsland, is very slight. The butts of large (and medium-sized) trees are usually clothed with a moderately thick coat of persistent old bark, not at all " stringy," but more like the base of large Peppermints (*radiata*), or even White Gums (*viminalis*), quickly tapering into a moderately rough softish bark, like that on the upper bole of most Peppermint trees, which again taper (or " fine ") off into a quite smooth bark at a few feet to, say, 8 or 12 feet from the ground. Above that the bark is quite smooth, whitish or tinted with green, and the old bark peels off in very long narrow ribbons, which often hang loosely on the tree, fast at the upper end, sometimes at both ends, and make a considerable noise in windy weather flapping against the tree trunks until they become further loosened and blow off. As a rule, the tree trunks above the first 5 to 10 feet are remarkably clean. The trees, where well grown, have, as a rule, small or scanty tops or heads, and there is very little loose ribbony bark hanging from the branches. In the Warragul district, where, on the lands cleared of the original forests, there are a good many young trees of *E. regnans*, growing by the roadsides or in waste places, the tree develops quite differently. It usually branches at a low height from the ground, say, generally 10 to 20 feet, with, proportionately, fairly large branches, and a rough scaly or flaky bark persists on the bole and to the basal parts of the large branches, and the upper part is less " clean " ; a good deal of the smaller " ribbons " of old bark clings to the branches, or is caught in the forks of the branches, and the tree often resembles a somewhat ragged specimen of *E. viminalis* much more than it does the noble *regnans*, as seen in the primeval forest. So much do the local conditions and environment alter the appearance and character of a tree.

In answer to a specific question as to any exceptional amount and character of rough bark in *E. regnans*, I received the following reply : " I do not know of anything that could be called Stringybark *regnans* or anything resembling a Stringybark form in *E. regnans*.

Bark (*E. fastigata*).—In defining the type it was stated to be to all intents and purposes a Stringybark. The tops of the trunks, and also, as a rule, the branches, are smooth.

Fruits (*E. regnans*).—Pear-shaped, truncate, valves not exsert. The fruit has a somewhat broad reddish disc, resembling that of *E. hæmastoma*. Sometimes the disc is oblique, and when the fruit is not contracted at the orifice, it bears a striking resemblance to *E. obliqua*, but it is smaller.

Fruits (*E. fastigata*).—Pear-shaped, domed, valves sometimes much exsert. The rather prominent domed disc with the exsert valves appears to be a fairly constant character of the species. It appears to be the only character which can be safely used to separate it from *E. regnans* on herbarium specimens. But see the remarks at p. , under "Illustrations." The domed character of the fruit is constant in cultivated specimens.

E. regnans is by far the commoner species in Victoria, and *E. fastigata* in New South Wales. The latter species also occurs in north-eastern Victoria, and I strongly suspect that *E. regnans* will be found in the extreme south of New South Wales, *e.g.*, in the Delegate district. I have some specimens attributed to this species, but they are not satisfactory.

2. With *E. obliqua* L'Herit.

The two species closely resemble each other in their fibrous barks, and they often occur in similar localities. In *E. fastigata* the branches are smooth, and in *E. obliqua* the reverse is the case. Mr. Hopkins, speaking of north-eastern Victoria, says that the timber of *E. fastigata* resembles that of the mountain or highland variety of Messmate (*E. obliqua*) (this has already been stated in describing the type), but is more free from gum-veins, and that it is a very useful timber for all builders' works. *E. obliqua* is figured at Plate 6, Part II, and in the coarseness of the juvenile foliage and in its leaf-obliquity generally, and in its fruits, it can be readily seen that the two species are very different.

3. With *E. vitrea* R. T. Baker.

E. fastigata is a Stringybark, while *E. vitrea* has the thinner Peppermint class of bark. As regards botanical details, Plates 33 and 34 may be compared, thus it is closely allied to *E. vitrea* in the buds, fruits and venation. Of the fruits of *E. vitrea*, some show a rather well-marked disc, but they are flat-topped as a rule with enclosed valves, not domed with exsert valves as in *E. fastigata*. The leaves of *E. vitrea* are thicker, and on the whole narrower, and the venation more longitudinal than those of *E. fastigata*.

DESCRIPTION.

CCCLIII. E. xanthonema Turczaninow.

In Bull. Moscow, xx, Part I, 163 (1847).

Following is the original description :—

Eucalyptus xanthonema ramis teretibus a basi ad inflorescentiam nudis; foliis super flores sitis alternis anguste lineari-lanceolatis, utrinque acuminatis, viridibus, pellucido-punctatis, subfalcatis; umbellis axillaribus 5 floris in paniculam contractum collectis; pedunculis erectis (demum forte deflexis) compressis, petiolo pedicellisque multo longioribus; pedicellis cupulam turbinatum aequantibus; operculo (immaturo) conico cupulam subaequante. Filamentis rufo aurantiacis insigne; habitus singularis. Nova Hollandia. Drum. Coll. N. 67.

A translation of the above will be found at Part XXXIV, p. 97, of the present work. It will be observed that the type is No. 67 of Drummond's third collection. The type is figured at Part XXXIV, Plate 140, fig. 8, and at figs 9*a* and 9*b*, Drummond's 5th Collection. No. 187 is also figured, the two numbers forming the co-types of *E. redunca* Schauer var. *angustifolia* Benth. As I am satisfied that it does not belong to *E. redunca*, the original name of *E. xanthonema* should be restored. When the amplest material is collected, the position can be reconsidered. If it be not a distinct species, we cannot say to what species it belongs. My present suggestion will best secure the interests of science.

SYNONYM.

E. redunca Schauer, var. *angustifolia* Benth. (in part).

"Leaves linear or linear-lanceolate. *E. xanthonema* Turcz. in *Bull. Mosc.* 1847, 1, 163; W. Australia, Drummond 3rd Coll. n. 67, 5th Coll. n. 187 (Drummond's No. 187 had better be kept separate for the present); S. side of Stirling Ranges and eastward to Phillips Ranges, Maxwell." *B.Fl.* iii, 253. It has been already figured, as stated. In the absence of complete material, I provisionally label Drummond's No. 187 *E. xanthonema* aff.

RANGE.

It is confined to Western Australia so far as we know at present. No. 67 was collected with James Drummond's 3rd Collection, which was made in a somewhat indefinite part of the south of the then colony. I have not seen Maxwell's specimens. which Bentham quotes under his *E. redunca* var. *angustifolia*. See Part XXXIV, p. 97.

AFFINITIES.

1. With *E. spathulata* Hook.

This has been already seen by Bentham (*B. Fl.* iii, 253; quoted in the present work, Part XXXIV, p. 98), but it has not the spathulate leaves of that species.

2. With *E. redunca* Schauer.

We have already seen that Bentham looks upon this as a narrow-leaved form of *E. redunca*, and simply says "Leaves linear or linear-lanceolate." We have not good fruiting specimens of *E. xanthonema*, but the obvious differences from *E. redunca* are the thicker, paler, more falcate lanceolate leaves of the latter.

In Part XXXIV, p. 97, while pointing out that *E. redunca* var. *angustifolia* is not an entirely satisfactory variety, I quote some specimens from Cunderdin and near Knutsford which should be further investigated, with complete material. They are figured at Plate 140, figs. 6*a*, 6*b*, and may be referable to *E. redunca*, but it is not probable that they belong to *E. xanthonema*.

DESCRIPTION.

CCCLIV. E. Schlechteri Diels.

In " Beitrage zur Flora von Papuasien viii," 423, (1922).

I HAVE not seen a specimen of the plant, nor a figure of it. Following is the original description :—

Arbor mediocris. Rami juniores (sicci) atropurpurei quadranguli. Foliorum petiolus brevis, lamina subcoriacea, supra lucida, late elliptica vel-ovato-elliptica, apice obtusa vel brevissime acuminata, nervi laterales primarii circ. 6 a costa abeuntes (sicci) subtus prominuli. Panicula pyramidalis, gracilis floribus parvis. Pedicelli 2–3 mm. longi. Receptaculum subhemisphaericum, operculum hemisphaericum, illi subaequale, vix vel brevissime apiculatum haud rostratum. Stamina omnia fertilia in alabastro inflexa, antherae minutae. Ovarium 3 loculare. Fructus parvi, valvis protrusis.

A tree only about 10 m. high (according to Schlechter). Petiole 5–8 mm. long, blade 9–10 cm. long, 6–7·5 cm. in width. Panicle 15–18 cm. long, and just about as broad at the base. Flower peduncle 2–3 mm. long, receptacle 2 mm. long, 2·5 mm. broad. Stamens (dried) about 4 mm. long. Fruit, including the operculum, about 3 mm. long and just as broad.

RANGE.

Confined to Papua, so far as we know at present. North Eastern Papua (New Guinea); at Waria, near Jaduna, 50 m. above sea-level (Schlechter, n. 17398—fruiting 3rd March, 1908 !); Forests of the mountains near Jaduna, about 200 m. above sea-level (Schlechter, n. 19242—flowering 15th April, 1909—type of species) . . . . *E. Schlechteri* is the first forest Eucalypt which has been shown from the New Guinea mainland. Species previously recognised from there are all elements of the Savanna flora (Diels, l*c*.).

AFFINITIES.

With *E. Naudiniana* F.v.M.

The species is allied to *E. Naudiniana*, but has broader leaves, not so tapering towards the apex, and almost obtuse, as well as distinctly smaller flowers and fruits. Moreover, according to Schlechter, it is not so tall as *E. Naudiniana*, which very frequently forms very tall trees (Diels, *l.c.*).

In the same work Dr. Diels gives a Review of the Papuan species, and this may be a convenient place to give his comparison with the three other species from that territory.

A. Leaves narrow-lanceolate, sickle-shaped. Inflorescence few flowered on a short peduncle. Flowers with pedicels . . . . .1 *E. papuana.*

B. Leaves broad lanceolate to ovate or broad elliptical.

a. Leaf stalk thin, up to 3 cm. long. Inflorescence axillary with a short broad peduncle. Flowers sessile . . . . 2. *E. alba.*

b. Leaf stalk thick, at the most 1 cm. long. Inflorescence a terminal, many-flowered panicle. Flowers stalked.

i. Leaves gradually tapering towards the apex, acute. Receptacle about 2 mm. long . . . . 3. *E. Naudiniana.*

ii. Leaves slightly tapering towards the apex, obtuse. Receptacle about 1 mm. long . . . . 4. *E. Schlechteri.*

XXIX. E. apiculata Baker and Smith.

Syn. *E. stricta* var. *rigida*, *Proc. Linn. Soc., N.S.W.*, xxii, 710 (1897), with a fig. (fig. 189, Plate 31). See Part IX, p. 286, and also Synonyms quoted.

RANGE.

Wentworth Falls, N.S.W. (in fruit, Henry Deane, about 1886); Leura (shrub 3–5 feet; December, 1907); Wentworth Falls (Dr. E. C. Chisholm, January and February, 1923). Hitherto the species has only been recorded from a southern locality (Berrima), while Wentworth Falls and Leura are westerly (Blue Mountains). Mittagong (see under Affinities) is at no great distance from Berrima. I expect to see the species from various localities connecting the southern and western records.

AFFINITIES.

1. With *E. stricta* Sieb.

In "Some Eucalypts about Mittagong" (*Aust. Nat.* v, 98, 1923), Mr. D. W. C. Shiress refers to ". . . . a single tree with every appearance of *E. stricta*, a Gum with scribbly bark, just before the turn off to Joadja." Mr. W. F. Blakely has since visited the district, in company with Mr. Shiress, and has brought back additional specimens. He says :—

> It is a slender tree 20 to 30 feet high and about 9 inches in diameter at 2 feet from the ground, growing in association with *E. radiata* and *E. maculosa*. Viewed from a short distance, it has the general appearance of a young sapling of *E. altior*, *i.e.*, a smooth powdery white-barked Gum, with the old bark slightly adherent at the base in long broad strips. It has, however, the narrow rigid leaves of *E. stricta*, and when this character is taken into consideration the thought of connecting it with *E. altior* (other than in the nature of the bark) is dismissed from the mind, and one wonders whether it is, after all, only a white-barked form of *E. stricta*. This idea is also dispensed with, for not more than 150 yards away, fringing Joadja Creek, *E. stricta* is seen in profusion, and when a comparison is made, both species of *E. stricta* and *E. apiculata* are found to be very dissimilar in habit and bark, and to some extent in the leaves. A branch, 3 inches in diameter, was cut and showed a white timber throughout.

Some of these specimens show the extreme difficulty, and perhaps impossibility, of separating *E. apiculata* from *E. stricta*, except perhaps as a variety, owing to the slightly greater width of the leaves in the Blue Mountains form. I have already (this work, Part IX, p. 286) alluded to the difficulty of separating the two species. But the Mittagong specimens indicate that *E. apiculata* and *E. stricta* may be a small-sized tree and a tall shrub respectively in the same locality. At the same time, *e.g.*, Blackheath, I have seen *E. stricta* exceptionally attain the size of a small tree. The broken country in the vicinity of the Berrima Coal Mine (type locality of *E. apiculata*) should also be searched for the tree-form of *E. apiculata*, for only bushy shrubs have been found there hitherto. The relations of *E. apiculata* and *E. stricta* are not yet settled.

XXXIII. E. Sieberiana F.v.M.

At p. 194, *Proc. Roy. Soc., Tas.*, 1912, Messrs. Baker and Smith attempt to prove that *E. virgata* Sieb. is identical with *E. Sieberiana* F.v.M. At Parts IX and X of the present work, I have very carefully gone into the subject, quoting my authorities. At p. 307 of Part X (1908) I said :—

> In " Eucalyptographia," under *E. Sieberiana* F.v.M., Mueller gives *E. virgata* Sieb., as a synonym. It is not proper to state it so. Mueller thought, when describing it, he was suppressing the " misleading " name *virgata* for it. The explanation is that *E. virgata* Sieber, was for many years confused by Bentham, by Mueller, and other botanists with the tree Mueller, in spite of himself, properly separated from *virgata* under the name *Sieberiana*. I have explained the situation under *E. virgata* at Part IX, p. 275 of this work, and need not repeat myself here.

I know no true synonyms of *E. Sieberiana* F.v.M.

Now Messrs. Baker and Smith, by an argument that is not clear to me, completely reverse my conclusions, returning, as I maintain, to the old confusion I had cleared up. This is part of their argument :—

> It seems hardly likely either that Sieber, having himself collected his two species in the field, should have given separate names to one and the same tree, for he was thus able to speak from actual acquaintance with their field characters, an experience that is invaluable as regards a knowledge of the Eucalypts.

In regard to this remark, I can say that, having examined every one of Sieber's numbered Eucalypts in the great herbaria of Europe, he is not always infallible in regard to this difficult genus, and little blame to him, while, as regards the reference to actual acquaintance with their field characters, the present writer speaks with infinitely greater experience that this old worthy could have possibly obtained during his rapid and brief collecting tours in New South Wales in the year 1822.

Messrs. Baker and Smith's cancelling of *E. Sieberiana* F.v.M. for the Tasmanian " Ironbark " after it has been adopted by Mueller (" Eucalyptographia " and " Second Census "), Rodway (" The Tasmanian Flora ") and myself, seems to be one of the most unfortunate confusions of nomenclature they have introduced into their paper. (Maiden in *Journ. Roy. Soc., Tas.*, p. 30, 1914.)

XXVIII. E. virgata Sieb.

In Part XXXIX, p. 283, I have given a resumé of the facts concerning the identification of *E. virgata* Sieb., which makes the position perfectly clear. We have had specimens of the type of *E. Sieberiana*, distributed by Mueller himself for very many years, besides which, correspondence with him has made it clear (if any doubt existed, of which I am not aware) as to what he meant. As regards Sieber's type of *E. virgata*, specimens have been in existence in herbaria for a century; they consist of leafy twigs bearing buds. It was therefore obvious that it would be only a matter of time when these specimens would be fully interpreted. I have explained my successful labours in the identification of the type, which are available for everyone to check.

In "Research on the Eucalypts," Ed. II, p. 310 (1920) Baker and Smith give a figure of two fruits of an imaginary *E. virgata*, with the localities Springwood, Lawson and Mount Victoria, all in the Blue Mountains, New South Wales; also Tasmania, in which the species does not occur.

Then follow the *ad captandum* arguments which in critical matters of taxonomy we are not unaccustomed to get from Mr. Baker's pen. At p. 310 he says:—"Our (Mr. Smith's and his own, but Mr. Smith is a chemist) action in regard to this species will no doubt be thought to be arbitrary, but we, on our part think that Oldfield, Woolls, Mueller and others, when dealing with type herbarium specimens, were in error in supposing that Sieber's specimens and specific name belonged to the "Mountain Ash" (*E. Sieberiana*). Sieber must have collected from a 'Mallee' when he bestowed the name *E. virgata* on his species." And so on. Mr. Baker has not fully figured *E. virgata*, and insists on not knowing what that species is. He therefore is incapable of understanding the position of the botanists (three named, "others" unnamed) he has quoted. I am content to leave it at that.

XLVI. E. acacioides A. Cunn.

Syn. *E. viridis* R. T. Baker in part.

I have received specimens of the above from the British Museum (through Dr. A. B. Rendle, F.R.S.) "near Peele's Range, N.S.W. (Oxley's 1st Exped., 1817), No. 203." Two of them were inadvertently labelled *E. stricta* by the British Museum. Peele's Range is in the neighbourhood of Rankin's Springs, 50 miles westerly of Wyalong, and was first named by Oxley (p. 45). The "Euryalean" brush, near the Range, was named at p. 50. "Mr. Cunningham went up Peele's Range in search of plants and found a few new ones" (p. 66). Peele's Range is different from Peel's Range, Liverpool Plains.

Allan Cunningham (Barron Field's *Geog. Mem.*, p. 350) named one of his Blue Mountain plants *E. microphylla*, and he cannot be held responsible for the act of someone who subsequently mislabelled it *E. acacioides* in the Hookerian herbarium in the year 1835. His *E. acacioides* was subsequently named *E. viridis* by Mr. Baker. I have already pointed out that that gentleman first amply described the plant as *E. viridis*, but I have no power to suppress *E. acacioides*.

LVI. E. Naudiniana F.v.M.

The following notes by Dr. L. Diels are taken from "Beitrage zur Flora von Papuasien viii," 422, 1922, edited by Dr. C. Lauterbach, and somewhat supplement those in Part XII, p. 79, of the present work.

E. Naudiniana F.v.M., in *Australasian Journ. of Pharmacy*, July, 1886; in *Botan. Centralblatt*, xxviii, 1886, 179. Rechinger in Karsten V. Schenck "Vegetationsbilder," vi. Reihe, Taf. ii, 1908; in "Streif zurge in Deutsch New Guinea," (p. 423), Taf. i (1908); in *Denschr. Math. Naturu. Kl. Akad. Wien.* lxxxix, 143 (1913).

RANGE.

Philippines. Bismarck Archipelago, New Britain: Spacious Bay, J. Turner, following F. v. Mueller. (Type of the species.) Baining Mountains, Matava, twig of a young tree, as well as a flowering branch of an old one, January, 1894 (Anonymous in Herb. Berol !); the same locality (Rechinger, n. 5347); Gazelle Peninsula (sent by Schmiele to F. v. Mueller, in Herb. Berol !). Without more definite locality (Parkinson !). New Ireland: Namatanai, on the Ouna, a tree 70 m. high in damp forests. Native name "Kumurere" (Peekel, n. 708—with young buds and young fruits, on the 19th November, 1910). This reference confirms the record of the Rev. G. Brown mentioned by F. v. Mueller as the first record of a Eucalypt for the Papuan country. He had noticed Eucalypts on his missionary travels in New Ireland. The young leaves (from a tree from Baining Peninsula about 1–3 years old) are somewhat narrower and thinner than those of the old tree, besides being all opposite. (Dr. L. Diels, *l.c.*)

LIX. E. Caleyi Maiden.

See Part XII, p. 95.

Synonyms.

1. *E leucoxylon* F.v.M. var. *pallens* Benth. (B.Fl. iii, 210), through Mueller's confusion of his *E. leucoxylon* with *E. sideroxylon* A. Cunn. This is explained in Part XII, pp. 84, 88, 91, 96.

2. The above is quoted without reservation as *E. sideroxylon* A. Cunn., var. *pallens* Benth., by Baker and Smith in "Research on the Eucalypts," Ed. I, p. 161, but Bentham never said so, so far as I am aware, and therefore the correct citation involving *E. sideroxylon* should be *E. sideroxylon* var. *pallens* Baker and Smith.

3. *E. cærulea* Baker and Smith. "Stunted Ironbark," Murrumbo, N.S.W., December, 1893 (R. T. Baker), at p. 271 "Research on the Eucalypts," 2nd Ed.

Some statements with the object of proving that *E. cærulea* is not *E. Caleyi* will be found at pp. 271 and 272, *op. cit.*, but I have for many years endeavoured to find a difference and have failed. These authors, it seems to me, make insufficient allowance for variation from type through changed environment in the case of *E. Caleyi*. I have had careful drawings made of the type of *E. cærulea*, but as I have been unable to show any essential difference between them and those of *E. Caleyi* in Plate 56, I could find no justification in publishing them. Some day oils of *E. Caleyi* from different sources will be obtained, and they will be compared with various oils from reputed *E. cærulea*.

RANGE.

See Part XII, p. 95. "Stunted Ironbark," Murrumbo, Rylstone (R. T. Baker, December, 1893), is at p. 96 quoted by me, and this is the plant which forms the type of *E. cærulea*. It extends from the Upper Hunter, N.S.W., to southern Queensland; the range in the latter State requires further investigation.

Following are additional localities for *E. Caleyi* :—

New South Wales.—Baerami, 14 miles west of Denman (R. H. Cambage, No. 2670); height 60–80 feet, diameter at 4 feet from the ground 2–4 feet. Sometimes stunted in growth, short bole. Used for fencing, building and fuel. Attunga State Forest, County Inglis, mountain slopes on the western side of the New England Range, altitude above sea-level 1,200–2,500 feet. (Assistant Forester T. W. Taylor); Bundarra (Assistant Forester A. Julius); Round-leaved Ironbark, a large tree with straight barrel; girth 10 feet. Bark dull grey, not deeply furrowed. Forest Reserve 35664, Parish Ironbark, County Darling, Barraba district. (Forest Assessor W. A. W. de Beuzeville); Parish of Dungowan, County Parry (District Forester Gordon Burrow); New England Ironbark. Trees of stunted growth, 20–30 feet high being a maximum growth, generally below 20 feet, with a girth of 2–4 feet, growing under similar conditions as *E. sideroxylon*, but inferior in quality, makes excellent fuel, Tent Hill, Emmaville district (J. L. Boorman); Westphalen's Lease, Parish of Elsmore, Inverell district (Forest Guard L. B. Peacocke); Road to Wallangarra-Ashford, 7 miles from the latter (Assistant Forester T. W. Taylor); Fraser's Creek, Ashford (J. L. Boorman).

Queensland.—Blackdown (R. N. Jolly); Brush Creek, Inglewood (J. L. Boorman).

LXIV. E. Baueriana Schauer.

Syn. *E. Fletcheri* R. T. Baker.

See Part XLII, p. 62, of the present work, also my " Forest Flora of New South Wales," Part LVII, p. 149, Plate 215. Also my paper in *Proc. Roy. Soc. Vict.*, xxxiv, p. 73 (1922), as to Victorian specimens. In " Research on the Eucalypts," Baker and Smith (2nd Edn.), p. 225, under *E. Fletcheri* the authors say—

" Maiden places this species under *E. Baueriana*, which was founded on an imperfect description and specimen 'in plump bud and an expanded flower' [Mr. Baker omits that the type specimens are branchlets 9 inches long.—J.H.M.], surely worthless data on which to perpetuate a systematic name. *E. Baueriana* is a tropical species."

It is not tropical, although Bentham (*B.Fl.* iii, 214) says so in the following passage, and Baker and Smith follow his error. Under *E. polyanthemos* Schauer he says—" The tropical specimens to which, from the character given, belong to *E. Baueriana* Schauer, in Walp. *Rep.* ii, 924, have generally smaller flowers and fruits than the southern ones, but do not otherwise differ." (*B.Fl.* iii, 214, 1866.)

Mueller (" Eucalyptographia " under *E. polyanthemos*, 1879–84), as quoted by me in the present work, Part XIII, p. 120 (1911) says—" Bauer most probably obtained his specimens from the vicinity of Sydney, and not from the tropical regions of Australia."

Nor did Schauer, the author of the species, 1843, say that *E. Baueriana* is tropical. He simply says " In Nova Hollandia legit F. Bauer " (see my quotation of the original description in this work, Part XIII, p. 120). If Mr. Baker has got evidence to modify or contradict Schauer, Mueller and myself, he should produce it.

I have seen the type, and it is imperfect to the extent that it only consists of mature leaves, plump buds and flowers. I only wish that *all* herbarium specimens of Eucalyptus were equally well furnished.

Mr. Baker repeats his depreciatory remarks as to the type specimens, and his observation as to " tropical origin " of *E. Baueriana* under *E. conica*, p. 95 (" Research, &c."). Besides Part XIII, p. 120, of the present work, see Part XLII, pp. 62 and 64.

Ettingshausen (" Die Blatt-Skelete der Dikotyledonen," p. 204, 1861) figures a leaf of *E. Baueriana*.

LXXV. E. falcata Turcz.

(Syn. *E. Dorrienii* Domin in Fedde's "Repertorium specierum nov. reg. veget.," xii, 388, 1913.)

The author says that in his opinion it is nearest to *E. decurva* F.v.M., and also compares it with *E. oleosa* F.v.M., and *E. falcata* Turcz. In comparing it with the last species, he says "*E. falcata* reminds us of it in the ribbed calyx-tube, but differs from it greatly in the operculum."

I am in possession of a quarto drawing of the type in the Kew Herbarium done by Miss M. Smith, and also of a fragment of the type. I fail to see in what way *E. Dorrienii* differs from *E. falcata*. The opercula of the two species are similar. See Plate 68, Part XV of the present work. The suggestion of the affinity of *E. Dorrienii* (*falcata*) with *E. decurva* is doubtless founded on the same error that I have pointed out in the present work, Part XVI, p. 193. The above note is taken from a paper by myself in *Journ. Roy. Soc. N.S.W.*, xliv, 328, 1915.

Mr. C. A. Gardner says this species is known as "White Mallet." It is a tree of 20-30 feet, with erect, or scarcely spreading branches; trunk to 12 feet high, and 12 inches in diameter; bark about ¼ inch thick, of a yellowish silver-grey colour in the summer when the outer layers have recently decorticated, almost pure white in the winter and blotched with large or smaller grey patches. Bark pink in fracture, the deepest colour near the external layers, the innermost almost white; timber light yellowish-brown, dense and very hard. Leaves thick, drooping, dull green, but shining. On laterite hills, 10 miles north-east of Wagin, in gravelly soil (shallow), forming open forests with *E. redunca* var. *elata*, and with a dense thicket-like undergrowth of *Dryandra*.

CXCIV. E. Spenceriana Maiden.

Height 20 to 35 feet, but occasionally attaining a height of 50 feet. Trunk to 20 feet and 18 inches diameter. Branches spreading or erect, few, and sparsely foliaged. Bark light grey, persistent and flaky, rugged or almost smooth, and very similar in texture to that of the Tuart (*E. gomphocephala*). Timber dark reddish-brown, dense with an interlocked grain. Sapwood thin, light yellow. The timber is termite-resisting. Leaves alternate, narrow lanceolate, drooping vertically, of a glaucous green, flat, the midrib prominent, but the veins inconspicuous, the intramarginal close to the edge. Veins at an angle of about 45 degrees to the midrib. Flowers not seen, but small and apparently white, in loose slender panicles, terminal or inserted just above the axils, not exceeding the leaves in length. Pedicels slender, slightly flattened. Calyx-tube turbinate, slightly compressed, tapering into the slender pedicel. Operculum depressed-conical, the line of separation fairly distinct. Stamens inflected in the bud. Style short, straight and thick. Fruits thin, ovoid, 3- or 4-valved, the rim thin and truncate, *the obtuse points of the valves sunk*.

(The above notes are by C. A. Gardner, and refer to Kimberley trees.)

RANGE.

Western Australia.—The common Grey Box of the basaltic areas of the Kimberleys, and the commonest Eucalypt of the district, and known as "Box" or "Coolabah." (I have seen a specimen from Walcott Inlet, Calder River, C. A. Gardner. No. 1589). The following are Mr. Gardner's notes :

Extending from the Lennard River in the south to Napier, Broome Bay, in the north, west to Camden Sound and Walcott Inlet, and indefinitely eastwards. The species covers the granite and basaltic areas of Kimberley, being restricted to this formation. It often forms pure savannah forests, but its most frequent associate is *E. clavigera*, a tree common to both igneous and sedimentary rocks. The foliage is never a bright green, and from a distance the trees indicate the best pasture land, their undergrowth being almost entirely Gramineæ, with larger shrubs. I have not seen a tree otherwise than on basaltic or granite country. It was undoubtedly the tree mentioned in Fitzgerald's Kimberley Report (1907) under the name of *E. microtheca*, when he stated "On the plains and frequently sparsely covering the basaltic hills, Coolibah or Box (*E. microtheca*) and Bloodwoods (*E. terminalis* and *E. pyrophora*) prevail, often forming open forests of fair extent, the species ultimately extending to the coast. (I have not seen either *E. terminalis or E. pyrophora* on the basaltic country)."

Northern Territory.—I provisionally refer the following specimens, received from the Melbourne Herbarium before 1900, to this little-known species. They are quite small, and in mature leaf and flower bud.

1. "North Coast and Bay 3" [Northern Territory.—J.H.M.], Robert Brown, 1802–5. Sent from the British Museum by direction of J. J. Bennett in 1876 as *E. polyanthemos* Schauer, and labelled by Mueller *E. drepanophylla* (?).

2. "Cape River" (Northern Queensland) "*E. polyanthemos*, petioles short." This is a modern specimen (? Stephen Johnson, Mueller's collector), and is in flower as well as bud.

CCI. E. radiata Si.eb

See Part XXXVIII, p. 229, where its description, synonymy and range are set out.

SYNONYMS.

1. *E. phellandra* Baker and Smith, "Research on the Eucalypts," 2nd Edn., p. 280, as follows, with a figure of an umbel of fruits.

Narrow-leaf Peppermint. A medium-sized tree, with a typical "Peppermint" bark. Abnormal leaves lanceolate, cordate, sessile, usually under 5 inches long and $\frac{3}{4}$ inch broad, upper surface darker in colour, branchlets scabrous, particularly so when young. Normal leaves thin, lanceolate or narrow lanceolate, sometimes falcate, up to 7 inches in length and 1 inch broad, on slender pedicels; venation distinct, intramarginal vein looped and well removed from the edge, a secondary less prominent vein often occurring nearer the margin, lateral veins very oblique, occasionally almost parallel to the midrib, distant and spreading. Peduncles usually axillary, 2 to 3 lines long, bearing umbels of ten or more flowers. Buds clavate; calyx-tube tapering into a slender pedicel; operculum hemispherical, umbonate. Fruit pyriform, sometimes hemispherical, more or less shining, on a pedicel 1 line in length; rim reddish, truncate, somewhat countersunk or even slightly convex; valves not or only slightly exserted; 3 lines long and under 3 lines in diameter.

Mr. Baker's figure is of seven fruits (with scars of a few more) in the umbel. They are not pyriform, but hemispherical; their comparative fewness and shape indicate *E. radiata*. It is quite evident that Mr. Baker has confused *E. radiata*, redescribing it under the name of *E. phellandra*.

2. *E. amygdalina* Labill., var. *nitida* Baker and Smith, but not of Benth.

Under this name Messrs. Baker and Smith, "Research on the Eucalypts," 2nd Edn., p. 278, have included two species. Specimens from Blackheath, N.S.W., September, 1919 (C. F. Laseron), furnished by the present Curator of the Technological Museum (Mr. George Hooper) are the common *E. radiata* of the Blue Mountains. No wonder the authors write, a little higher up the page, "The data given under *E. phellandra* applies (*sic*) in almost every particular to this species, so that no systematic description is required"!!! Material was distilled from Blackheath. In "Research on the Eucalypts," 2nd Edn., Messrs. Baker and Smith say "As illustrating the comparative constancy in results with the products of individual species, it may be mentioned that the above localities are over 600 miles apart." The two trees so many miles apart, with the same oils, are, however, not the same species, but two, viz., *E. radiata* and *E. nitida*, and this is not the only case of two different species yielding similar oils.

CCII. E. numerosa Maiden.

See Part XXXVIII, p. 233, where the synonomy is set out.

The plant noted as *E. radiata* Sieb., by Messrs. Baker and Smith ("Research," 2nd Edn., p. 306), with a figure of an umbel of pyriform fruits and called "White Top Peppermint or River White Gum" is *E. numerosa*, a very characteristic graceful tree, with ribbony bark used as tying material by the blacks. It is found on river banks and hill-sides. It has fruits more numerous and more pyriform than *E. radiata*. I have sufficiently characterised *E. numerosa*, where quoted above, and well know my own species both in the bush and in the herbarium. It is quite obvious that Mr. Baker has confused my *E. numerosa* with the older *E. radiata*.

CCIII. E. nitida Hook. f.

Syn. *E. amygdalina* Labill., var. *nitida* Benth. See Part XXXVIII, p. 235, of the present work. See also Part XXXIX, p. 302, for a note, and at fig. 1, Plate 160, the broad juvenile foliage of this species (reproduced from the figure accompanying my paper in *Proc. Roy. Soc. Tas.*, 1918) will be found.

The specimens labelled *E. amygdalina* var. *nitida*, Guildford Junction, Tasmania (L. G. Irby, September, 1918—specimens received from Mr. George Hooper, the present Curator), referred to by Messrs. Baker and Smith in "Research on the Eucalypts," 2nd Edn., p. 279, are *E. nitida*. Messrs. Baker and Smith include *E. radiata* and *E. nitida* under the one name of *E. amygdalina* var. *nitida*, and I have drawn attention to the matter under *E. radiata* at p. 19.

In the absence of complete material, the Mount Victoria specimens (Maiden and Cambage, *Journ. Roy. Soc. N.S.W.*, xlviii, 415 (1914, Kydra Trig. Station, *ib.* 416), and certain anomalous specimens from Blackheath (Maiden, *Paper and Proc. Roy. Soc. Tas.*, p. 84, 1918) should be eliminated from *E. nitida*. *E. nitida* has only been proved to occur in Tasmania up to the present time.

CCLII. E. eremophila Maiden, var. *grandiflora* n. var.

Synonym.

E. occidentalis var. *grandiflora* Maiden, Part XXXVI, p. 149, and figs. 1–2. Plate 150.

The Kurrawang specimen (J. B. Cleland) there quoted is the type, and I look upon the Elder Exploring Expedition specimen, Camp 63 (R. Helms), as also belonging to this variety. The variety *grandiflora* differs from normal *E. eremophila* in the longer calyx and in the larger fruits. The calyx is remarkably long and cylindrical, being nearly twice as long as that of the normal form. It also appears to be much thinner in texture, the normal form being more cupular and thicker.

Concerning this little known species. Mr. James Richardson of Parker's Road, E. Goldfields Railway (through Mr. E. Le Souef), writes:—

"Yellow flowering Mallee. The flowers sent (3.11.21) were the top of Mallee shoots 7 feet in height, and had previously bloomed. The butt of the suckers was no larger than a walking stick. These are the first to bloom, others will be in during the next two weeks. I have found about fifty clumps of it, and it certainly deserves a place in every public garden."

A week later (letter of 10.11.21) he sends more, under the name of "A large flowered Mallee, colour canary-yellow. It grows about 7 miles west of Parker's Road on the old Merredin to Southern Cross Road near iron telegraph pole No. 2804, and near the railway at 217¼ miles, near telephone pole No. 4322. It is quite distinct from the red-flowering Mallee, and not a colour sport. The late Mr. E. Simpson, manager of Jones' Station, 30 miles north of Nungarin, reported to me over twelve months ago that he discovered a yellow Mallee on Jones' Station; it is probably the same."

ENEMIES OF EUCALYPTS.

This subject is dealt with, as regards trees in general, at Part LVIII, p. 209, of my "Forest Flora of New South Wales." The Synopsis is as follows, and as the details there given refer to Eucalypts, amongst others, I refer my readers to the paper, and will content myself with some supplementary notes.

I. Meteorological.
- (*a*) Frost.
- (*b*) Snow.
- (*c*) Wind. Twist in Timber.
- (*d*) Lightning.
- (*e*) Drought.
- (*f*) Rain.

II. Fires.

III. Soil.
- (*a*) Unsuitable soil. Alkali.
- (*b*) Sand encroachment.

IV. Parasites
- (*a*) True Parasites. (Mistletoe, &c.).
- (*b*) Hemi-epiphytes. (Strangling Figs).
- (*c*) Fungi.
- (*d*) Weeds.

V. Animals.
- (*a*) Grazing.
- (*b*) Native animals.
- (*c*) Birds.
- (*d*) Insects.

VI. Miscellaneous.
- (*a*) Fumes from furnaces, &c.
- (*b*) Artificial lighting.
- (*c*) Destruction by aborigines.

I. Meteorological.

(*a*) Frost.

1. Graham Officer (*Proc. Roy. Soc., Tas.*, 1892, p. 155) referring to the Nive Plains near Lake St. Clair, speaks of them being "covered with dead and fallen trees, the result of a severe frost 50 or 60 years ago."

2. " Relative Frost Resistance of Eucalyptus in Southern California," by E. N. Munns, *Journ. of Forestry*, XVI, 412 (April, 1918). In this paper twenty-six species are dealt with. A few of the vernaculars are open to possible correction, *e.g.*, *E. polyanthema*, which is called " Australian Beech," perhaps a misplaced label, for such a name is quite unknown in Australia. *E. amygdalina* is called " Giant Eucalypt." Perhaps *E. amygdalina* var. *regnans*—*E. regnans*—is meant. *E. leucoxylon*, " White Wood." This is a mistake, although it is sometimes called " White Ironbark." The author of the specific name *regnans* (p. 422) is Mueller. *E. goniocalyx*, " Box-wood." Box-wood is not an Australian wood, though " Box " is. *E. calophylla*, " Feather-veined Gum." This is evidently a Californian name for the " W.A. Red Gum," but it is descriptive of all the Corymbosæ.

One of the conclusions in a useful paper is that *E. viminalis* is the most frost-hardy species of the genus that has so far been planted in Southern California, followed by *E. polyanthemos*, *E. Gunnii*, *E. bicolor*, and *E. regnans*. It is quite evident, however, that the original seeds were not obtained from the most frost-resistant localities in all cases.

(*b*) Snow.

See Dudley Le Souef, " Effect of Snow on Eucalyptus trees," (*Vict. Nat.*, 18, 108–110, 1901).

(*c*) Wind.

Effect of wind. See Fissility (timbers), Part LIV, p. 208.

See my " Forest Flora of New South Wales," Part LX, for two remarkable photographs showing :—

(*a*) " Wind-blown trees, Stanley, North-west Coast, Tasmania. (These illustrate the dwarfing or nanism caused by strong sea-breezes in exposed situations.)

(*b*) " A Cypress Pine (*Callitris robusta*. R.Br.) after a Cyclone, Cambo Cambo Station, Collarenebri district, N.S.W." This shows the devastation in a forest, including the cyclonic or twisting force, and the disintegration of the timber into long splintery masses.

IV. Parasites.

(*a*) True Parasites (Mistletoes).

I am indebted to Mr. W. F. Blakely, my Botanical Assistant, for the following lists, and hope the publication of them will lead to much fuller interest being taken in the subject. (Suggestions as to dealing with Australian Mistletoes have been scanty.) See the non-Australian reference, "Some Suggestions on the Control of Mistletoe in the National forests of the North West " (U.S.A.). (*Forestry Quarterly*, XIV., 567 December, 1916.) [See also Schlich's " Manual of Forestry," IV, 366.]

Phrygilanthus eucalyptifolius (Sieber) Engler, has been found on the following species :—

E. acmenioides.
E. amplifolia.
E. Baeuerleni.
E. Bancrofti.
E. capitellata.
E. cinerea.
E. corymbosa.
E. crebra.
E. eugenioides.
E. eximia.
E. ficifolia.
E. haemastoma.
E. hemiphloia.
E. longifolia.
E. melanophloia.
E. micrantha.
E. notabilis.
E. ochrophloia.
E. ovata.
E. paniculata.
E. Parramattensis.
E. pilularis.
E. piperita.
E. punctata.
E. radiata.
E. resinifera.
E. saligna.
E. Shiressii.
E. siderophloia.
E. sideroxylon.
E. Sieberiana.
E. squamosa.
E. tereticornis.
E. umbra.
E. viminalis.
E. Watsoniana.

P. celastroides (Sieb.) Eichl., on *E. tereticornis.*

Loranthus sanguineus F.v.M. on

E. grandifolia.
E. microtheca.

L. bifurcatus Benth. on

E. clavigera.
E. dichromophloia.
E. terminalis.
E. transcontinentalis.

L. Miquelii Lehm. on

E. acmenioides.
E. albens.
E. Baileyana.
E. Bancrofti.
E. Baueriana.
E. bicolor.
E. Blakelyi.
E. Caleyi.
E. calophylla.
E. corymbosa. (Common host, Northern Rivers of N.S.W.)
E. dealbata.
E. dumosa.
E. elaeophora.
E. eugenioides.
E. fasciculosa.
E. gomphocephala.
E. hemiphloia.

L. Miquelli—continued.

E. leucoxylon.
E. macrorrhyncha.
E. maculata. (Common host, Northern Rivers of N.S.W.)
E. melliodora.
E. microcarpa.
E. odorata.
E. Oldfieldii.
E. paniculata.
E. Pilligaensis.
E. pilularis.
E. piperita.
E. propinqua.
E. punctata.
E. redunca.
E. resinifera.
E. rostrata.
E. saligna.
E. Seeana.
E. Shiressii.
E. siderophloia.
E. sideroxylon.
E. tereticornis. (Common host, Northern Rivers of N.S.W.)
E. umbra.
E. viminalis.

L. pendulus Sieber on

E. acaciaeformis.
E. albens.
E. Bancrofti.
E. Baueriana.
E. Blaxlandi.
E. conica.
E. crebra. (On trunk.)
E. dealbata.
E. dives.
E. elaeophora.
E. eugenioides.
E. haemastoma.
E. hemiphloia.
E. ligustrina.
E. macrorrhyncha.
E. maculosa.
E. micrantha.
E. Moorei.
E. Muelleriana.
E. pilularis.
E. piperita.
E. polyanthemos.
E. radiata.
E. rostrata.
E. rubida.
E. Sieberiana.
E. stricta.
E. Stuartiana.
E. viminalis.

L. ferruginiflorus W. V. Fitzgerald on—

E. acmenioides.
E. Baileyana.
E. Bancrofti.
E. clavigera.
E. corymbosa. (Common host.)
E. eugenioides.
E. hemiphloia.
E. maculata. (Common host.)
E. microcorys.
E. pilularis.
E. propinqua.
E. Seeana.
E. tereticornis.
E. tessellaris.
E. trachyphloia.

L. Quandang Lindl. on

E. bicolor.
E. crebra.
E. melanophloia.

L. grandibracteus F.v.M. on

E. bicolor.
E. microtheca.
E. Normantonensis.
E. populifolia.

L. congener Sieber on *E. obtusiflora.*

L. miraculosus Miq. on

E. gomphocephala.
E. conica.
E. Baueriana.

L. miraculosus Miq. var. *Boormani* n. var. on *E. bicolor.*

L. Exocarpi Behr. on

E. populifolia.
E. rostrata.

L. Exocarpi Behr. var. *spathulata* Blakely on *E. pyrophora* var. *polycarpa.*

L. homoplasticus Blakely n. sp. on *E. alba.*

L. odontocalyx F.v.M. on *E. sp.* Probably one of the Corymbosæ.

L. vitellinus F.v.M. on

E. acmenioides
E. Baileyana.
E. calophylla.
E. corymbosa. (The most common host.)
E. eugenioides.
E. eximia. (Also a common host.)
E. haemastoma.
E. maculata.
E. micrantha.
E. notabilis.
E. obtusiflora.
E. paniculata.
E. piperita.
E. punctata.
E. rubida.
E. Shiressii.
E. viminalis.

L. vitellinus F.v.M. var. *glabrescens* n. var. on

E. alba.
E. melanophloia.
E. microtheca.
E. terminalis.

See Mr. Blakely's papers on Loranthaceæ in *Proc. Linn. Soc., N.S.W.*, XLVII. They include a very large number of references to species parasitic on Eucalyptus, together with excellent drawings of the parasites themselves.

Following is a note on a parasite allied to the Sandalwood, which is worth emphasising, as we have notes on so few parasites other than the Mistletoes.

Speaking of *E. calycogona* Turcz., at Pinnaroo (J. M. Black, *Journ. Roy. Soc., S.A.*, XLIII, 39, 1919) " In many instances specimens of *Fusanus acuminatus* (' Native Peach ') were growing—probably parasitically—so close to these trees that the stem of the *Fusanus* was impressed into that of the *Eucalyptus*, forming a deep channel along one side.

(*b*) Hemi-epiphytes (Strangling Figs).

" Effects of growing cells on Environment," and " Disruptive Force of Fungi, Roots, &c." (Kerner and Oliver, I, 513) may be referred to. Fig. 130 shows elevation of a block of stone in consequence of the growth in thickness of a Larch root. Its weight is estimated at 1,400 kg., and the root concerned is only 30 cm. in thickest diameter. " An instance is also known in which a stone of 160 kg. (352 lb.) was raised and shifted by the growing fructification of a fungus of the mushroom tribe " (p. 514).

Other trees are quoted, but they all dwarf into insignificance in their effects as compared with the devastation caused by tropical Figs (*Ficus*). I have no illustrations of Eucalypts, but observers have often noticed what great disruptive force they are capable of exercising.

Epiphytes.

One of the most charming sights I have ever seen was that of huge masses of *Dendrobium aemulum* R.Br., flowering on the trunks of *E. paniculata* at Wyong, N.S.W.

Cymbidium canaliculatum R.Br., is epiphytal on spp. of Eucalyptus in New South Wales, but especially on *E. clavigera* A. Cunn. in N. W. Australia (W. V. Fitzgerald). It is common on Box trees, resting in the forks. These epiphytes do not injure the trees, so far as I know. The subject of epiphytes on our Eucalypts may well be taken up by an observer.

(*c*) Fungi.

I am much indebted to Mr. Edwin Cheel, my chief Botanical Assistant, who has favoured me with the following valuable list and notes of fungi recorded as having been found on various species of Eucalyptus. Unfortunately, the particular Eucalypt is not mentioned in very many cases. It is obvious that there is still a wide field of research indicated by Mr. Cheel.

The list includes 113 species, representing 31 families and 71 genera of fungi, found on 35 species of Eucalyptus. Cooke and Harkness (2) have recorded 42 species.

representing 32 genera, found on *E. globulus* cultivated in California. Thumen has also recorded a species of Eucalyptus cultivated in Portugal. Six species of those enumerated in Cooke and Harkness (2) have also been definitely recorded as having been found in Australia, and are accordingly included in the list herewith.

It is interesting to note that of the 35 species of Eucalyptus specifically mentioned, *E. globulus* is the host of the largest number of species of fungi in Australia, as well as in California, 12 species having been actually recorded on this host. This is owing to the circumstance that this species was for many years the commonest species cultivated abroad. *E. viminalis* comes next with 7 species and *E. amygdalina* with 4. The various species of Polyporaceæ are the most numerous and worst foes of Eucalypts, as they attack the living trees as well as the dead wood. Even fence-rails and building material after it has been dressed is frequently attacked by the Polyporaceæ, and many thousands of pounds worth of timber are destroyed in the course of a few years by the ravages of this group alone.

Family Pezizaceæ.

Lachnum atro-purpureum Durant on bark (12). (These numbers refer to "Bibliography," see p. 33.)

Family Heliotiaceæ.

Phialea ceratina Berk. on leaves (Tas.) (7).

Dasyscypha eucalypti (Berk.) Sacc. on leaves and so on (Tas. and Vict.) (13).

Family Stictidaceæ.

Stictis radiata Fr. on bark of *E. globulus* (Tas.) (13) and (2).

S. emarginata Cke. et Mass. on leaves (Vict.) (13).

Family Phacidiaceæ.

Coccomyces delta Kunze on leaves (7) and (13).

Family Hysteriaceæ.

Hysterium pulicare Fr. on bark of *E. globulus* (2).

Lembosa orbicularis Winter on leaves of *E. pilularis* (13).

Aulographum eucalypti Cke. et Mass. on dead leaves (Vict.) (13).

Family Patellariaceæ.

Patinella Adamsii Sacc. on branches (Vict.) (13).

Family Perisporiaceæ.

Meliola amphitricha Fr. on leaves (Vict. and Qld.) (13).

M. densa Cke. on leaves, Herbert River, North Queensland (13).

Family Microthyriaceæ.

Microthyrium amygdalina Cke. et Mass. on leaves of *E. amygdalina*, S.A. (species not indigenous in S.A.) (13).

Micropeltis applanatus var. *depauperata* Sacc. on leaves of *E. tereticornis*, Queensland (14) and (13).

Asteridium eucalypti Cke. et Mass. on leaves of *E. amygdalina* (Vict.) (7) (12) (14).

Family Dothidiaceæ.

Dothidella inequalis Cke. on dead leaves (Vict.) (13).
Phyllachora maculata Cke. on leaves (Vict.) (13).
Baguisiella rugulosa Cke. on leaves (Vict.) (13).

Family Mycosphærellaceæ.

Mycosphærella (*Sphærella*) *cryptia* Cke. on fading leaves (Vict.) (7).
Mycosphærella (*Sphærella*) *nubillosa* Cke. on living leaves (Vict.) (7).

Family Pleosporaceæ.

Montagnella rugulosa Cke. on leaves (Vict.) (13).
Montagnella eucalypti Cke. et Mass. on dead leaves (Vict.) (13).

Family Massariaceæ.

Massarinula appendiculata Fl. Tass. on *E. punctata*, N.S.W. (17).
Massaria eucalypti Fl. Tass. on *E. Watsoniana* F.v.M., Queensland (17).

Family Clypeosphæriaceæ.

Trabutia eucalypti Cke. et Mass. on leaves, Tas. and Vict. (13).

Family Obtectaceæ.

Rhamphora tenella Sacc. on leaves of *E. viminalis*, Mariatta, S.A. (7) and (13).

Family Thelephoraceæ.

Stereum hirsutum Willd. on *E. tereticornis*, Bumbery; *E. Stuartiana*, Orange (11); *E. globulus* (18).
Stereum fasciatum Frier, on trunks, S.A., Vict. and Qld. (13).
Hymenochæte Kalchbrenneri Mass. on trunks, Vict. and Qld. (13).

Family Polyporaceæ.

Polyporus australiensis Wakef., Nattai River, Colo, N.S.W. (10).
Polyporus eucalyptorum Fr. on trunks of *E. resinifera*, *E. tereticornis*, *E. corymbosa*, *E. nova-anglica*, *E. pilularis*, *E. eugenioides*, *E. capitellata*, *E. Caleyi*, *E. maculata*, *E. Sieberiana*, and *E. sideroxylon* (10) and (13).
Xylostroma giganteum Todc. (This is the sterile mycelium in part of *Polyporus eucalyptorum*, and probably other species of Polyporaceæ commonly found in the hollow trunks of Eucalyptus spp. See (10), pp. 505, 506, 510, 511, 514, 515, 517, 522, and 523.
Polyporus sulphureus (Bull.) Fr. (18).
P. Hartmanni Cke. on *E. quadrangulata*, Jellore Creek, *via* Mittagong, N.S.W. (10).
P. pocula (Schw.) Berk. et Curt. on bark (18).
P. ochroleuca Berk., Lilyvale (10).
P. phlebosporus Berk. on trunk of *E. hemiphloia*, Queensland (13).
P. subradiatus Lloyd (18).

Family Polyporaceæ—*continued.*

P. spumens Frier., Vict. (13).

P. (*Lentus*) *arcularius* Batsch. on *E. rostrata*, Moree, N.S.W. (10).

Polystictus cinnabarinus Jacq., Gympie, Qld. (11).

P. lilacino-gilva var. *eucalypti* Lloyd. (*Trametes eucalypti*) (*Polystictus eucalypti* Kalchb.) on trunks, S.A., Vict., Qld. (13) and (10).

Fomes robustus Karst. on *E. rostrata*, Adelaide, *E. viminalis*, Tasmania, *E. sp.*, Penshurst, N.S.W. (10).

E. botryoides, Sydney, and *E. saligna*, Robertson, N.S.W. (11).

F. obliquus Cke., S.A., Vict., N.S.W., and Qld. (13).

F. Robinsoniæ Murrill on *E. melanophloia*. On *E. crebra* and *E. sp.*, Narrabri, N.S.W. (10).

R. rimosus Berk. on *E. crebra* and *E. melanophloia*, Narrabri, and *E. paniculata*, Brisbane (10) (18) (11).

F. yucatensis Murrill on *E. saligna*, Lisarow, N.S.W. (10).

F. conchatus Pers. on *E. piperita* (10).

Trametes Feei Fr. (10).

Hexagona bicolor McAlp. on *Eucalyptus sp.* (referred to *Woollsiana*) (16).

H. Gunnii Berk. on *E. viminalis*, Tas. (10).

H. Muelleri Berk. (13) and (16).

Merulius lachrymans (Dry-rot Fungus).*

Poria mollusca Cke. on *E. obliqua*, S.A., Vict. (13).

Family Agaricaceæ.

Pleurotus eucalyptorum Fr. on trunks (3) (13).

P. affixus Berk. on bark of *E. amygdalina* (3) (13).

P. applicatus Batsch. on *E. viminalis* (7) (13).

Crepidallus haustellaris Fr. on trunks of *E. viminalis*, S.A. (13).

Paxillus eucalyptorum Berk. (4).

Marasmius putredinus B. and C. (7).

M. lygnyodes Berk. on leaves (7).

M. meloniformis Berk. on leaves and branches (13).

M. eucalypti Berk. on fruits and twigs (1).

Naucoria horizontalis on *E. piperita* (9).

Lentinus hepatotrichus Berk. on Stringy-bark Gum tree (*E. ? sp.*) (1).

Panus lateritius Sacc. on rotten wood (13).

Lenzites aspera (Kl.) Fr. on *E. globulus* (18).

Family Lycoperdaceæ.

Xylopodium australe Berk. on trunk of *E. hemiphloia*, Vict., N.S.W. (15).

* G. A. Julius (W.A. Timber Tests, 1906, Schedule 5) gives chemical analyses of seven Western Australian timbers, and at p. 22 he has some remarks on the relation between Dry-rot and the decomposition of the sap. See also J. Mann's "Australian Timber; its Strength, Durability, and Identification," p. 68. Also "Dry-rot in Timber," by G. P. Darnell Smith in *Aust. Forestry Journ.*, October, 1919, p. 314. There are also treatises entirely devoted to the subject of Dry-rot in Timber.

Family Sclerodermataceæ.

Pisolithus crassipes (*Polysaccum crassipes*). This species is nearly always found on the soil under *E. spp.* in Australia. E.C. (18).

Family Nidulariaceæ.

Cyathus pusio Berk., Qld. (4).

Fungi Imperfectæ.

Family Sphærioidaceæ.

Macrophoma Molleriana (Thuem.) on leaves of *E. globulus*, Vict. (7).
Phoma australis Cke. on leaves, Vict. (7).
P. viminalis Cke. et Mass. on *E. viminalis*, Vict. (7).
P. eucalyptidea Thuem. on leaves, Vict. (7).
P. purpurea Cke. et Mass. on leaves, Qld. (13).
Staganospora orbicularis Cke. on dead leaves, Vict. (13).
Dothiorella eucalypti Sacc. on leaves, Vict. (13).
Sphæropsis phomatoidea Cke. et Mass. on leaves, Vict. (13).
S. eucalypti Berk. et Br. in Nat. Herb. Syd.
S. stictioides Earle, in Nat. Herb. Sydney.
Diplodina Watsoniana Fl. Tassi. on *E. Watsoniana*, Queensland (17).
Hendersonia eucalypti Cke. and Hark. on twigs of *E. globulus*, Vict. (2) and (13).
H. grandispora McAlp. on leaves, Wangaratta, Vict. (15).
Camarosporium eucalypti Wint. on leaves, Vict. (7) (13).

Family Nectroidaceæ.

Martinella eucalypti Cke. on leaves, Vict. (12) (13).

Family Leptostromataceæ.

Leptothyrium aristatum Cke. on dead leaves, Vict. (7) and (13).
L. eucalyptorum Cke. et Mass. on leaves, Vict. (7) and (13).
Piggotia substellata Cke. on leaves, Vict. (7) and (13).
Melasmia eucalypti Cke. et Mass. on dead leaves, Vict. (7) and (13).
Sacidium eucalypti Cke. et Mass. on dead leaves of *E. globulus*, Vict. (13).
Leptostromella eucalypti Cke. et Mass. on leaves of *E. incrassata*, Vict. (7) and (13).

Family Excipulaceæ.

Protostegia eucalypti Cke. et Mass. on leaves of *E. incrassata*, Vict. (7) and (13).

Family Melancoriaceæ.

Gloeosporium eucalypti McAlp. on leaves of *E. cladocalyx* (*E. corynocalyx*) (16).
G. nigricans Cke. et Mass. on leaves of *E. coriacea* (*pauciflora*), *Vict.* (6) and (16).
G. ochrostichum Sacc. on leaves of *E. coriacea* (16).
G. capsularum Cke. et Hark. on fruits (6).
Pestalozzieila circulare Cke. et Mass. on leaves of *E. coriacea* (13).
Also on *E. parviflora* (7).

Family Melaucoriaceæ—*continued.*

Pestalozzina exilis Fl. Tassi. on leaves of *E. eximia*, N.S.W. (17).

Stilbospora foliorum Cke. on leaves, Vict. (13).

Pestalozzia monochæta Desm. on leaves of *E. globulus* (2) and (13).

P. funerea Desm. on twigs of *E. globulus* (2) and (13).

P. inquinans Cke. et Hark. on leaves (6).

Coryneum viminale Cke. et Mass. on leaves of *E. viminalis*, Vict. (13).

Cylindrosporium eucalypti McAlp. on *E. melliodora*, Dandenong Creek, Vict. (15).

Hyphomycetes.

Family Mucediniaceæ.

Penicillium glaucum Link. on twigs of *E. globulus* (2) and (13).

Family Dematiaceæ.

Hormiscium pithophyllum Nees, on leaves and branches, S.A., N.S.W. (13).

Clasterosporium clavatulum (Cke. et Hark.) (*Bactrodesmium clavatulum* Cke. et Hark.) on bark (7).

Cercospora epicoccoides Cke. et Mass. on leaves, Vict. (13).

C. eucalypti Cke. et Mass. on leaves, Vict. (13).

Family Tuberculariaceæ.

Illosporium obscurum Cke. et Mass. on *E. globulus*, Vict. (13).

Hymenula eucalypti Cke. et Mass. on leaves, Vict. (13).

Family Stilbaceæ.

Fusarium rubicolor Berk. et Br. on leaves, Qld. (13).

Mycetozoa (Myxogastres).

Family Liceaceæ.

Tubulina cylindrica (Bull,) var. *nitidissima* on leaves of *E. microtheca*, Qld. and Tas. (13).

Schizomycetes.

Family Bacteriaceæ.

Bacterium eucalypti Greig Smith, in "Manna" from *E. punctata*. *Proc. Linn. Soc. N.S.W.*, xxviii, 831 (1903)

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d. Weeds.

In Annual Report, Forestry Commission, N.S.W. (up to 30th June, 1919), p. 27, is a note on the growth in twelve months of certain trees (*E. maculata, E. pilularis, E. saligna*) affected and not affected by the strangling vines of *Kennedya rubicunda*, near Wyong, N.S.W. It had been brought under notice by Mr. F. G. McPherson, the local District Forester, Wyong, who reported—

> "This vine is superabundant at present throughout the forests in this district, especially on areas which have been improved, where they attack and cover up the young hardwood trees in a very short space of time. I know areas where re-afforestation is good and young trees up to from 2 to 5 feet high are plentiful, but they are all hidden from view by this vine. I am afraid it will menace the forests by retarding the growth of the young trees."

The answer that I gave was as follows :—

> "A native of Australia. In open sandstone country it is usually a trailer, but in the scrub it is a vigorous climber. The point you raise is a very interesting one; there is, in effect, a struggle going on between the vine and the young trees. Probably it would not pay for the forester to interfere in the struggle as a rule. But I expect that, in the vast majority of cases, the young trees will shoot up and leave the humbler vine, the leaves of which may have some manurial value for the forest. Firing the land very much helps the dissemination of a vine like this, as it burns off its enemies and facilitates the germination of the seed of the vine."

Vines twine round other plants and sometimes destroy them, but some of them (*Vitis*) have the redeeming quality that they contain water, which can be obtained by

cutting them in pieces about a foot long, and draining them into a receptacle. *Ipomaeas* (Morning Glory), and many other twiners develop the strangling habit. I have referred to the matter and given illustrations under the title "Aboriginal Method of obtaining Water," at p. 14, Part LI, of my "Forest Flora of New South Wales."

V. Animals (Native and other).

See my "Forest Flora of New South Wales," Part LXX, p. 444, where the subject is, although inadequately, dealt with at some length.

VI. Miscellaneous.

Hand of Man.

The deliberate destruction has arisen from two causes—(1) the destruction of trees to convert them into timber; and (2) the destruction of trees and shrubs in the formation or improvement of pastoral and arable land.

In (1) the requirements of engineering and mining works, building, fencing, furniture, &c., have to be provided for. Under (2), the burning off has been incessant, but a fair percentage of dead timber has been converted into household fuel in the vicinity of towns. In Western Australia the cutting of green timber for fuel purposes in the vicinity of the goldfields is, because of the local scarcity of coal, carried out to an extent unknown in eastern Australia. Since the removal of all large timber in the vicinity of the gold-fields areas is complete, data should be obtainable in regard to the rate of growth of many species in definite areas, natural re-afforestation being usually allowed to proceed. Chiefly in South Australia there are large forest plantations, this being largely a treeless State. Victoria and New South Wales are doing some planting.

The compensating extent of natural re-afforestation is considerable, although sometimes lost sight of. Some species, *e.g.*, *Eucalyptus pilularis* Sm., re-afforest rapidly in forest land, and it is believed that the seeds of forest trees, which pass through sheep and cattle, and which are trampled into the soil, are responsible for the conversion of large areas of grass land into forest in the eastern States. (See Part XLVIII, p. 248.)

The removal of the trees of a forest destroys the plant equilibrium, and interesting changes, which, however, cannot be discussed at this point, take place, particularly in the brush.

VII. THE INFLORESCENCE, and VIII, THE FRUIT—(*concluded*).

DECIDUOUS STAMINIFEROUS RING.

a.—Continuous.

b.—Discontinuous (Eudesmieæ.)

Bentham (B. Fl. III, 185) speaks of "Stamens numerous, in several series" . . . . Mueller "Stamens inserted close to the edge of the calyx tube in several rows" (Eucalyptographia).

The staminal ring is an annular membrane to which are attached the stamens in more than one row. It is persistent in the majority of species, but deciduous in a few. In those cases in which it is deciduous, the ring may be pulled off (or drops off) with the stamens attached. Probably in most species (in which it passes as persistent) it is deciduous at an early date. In a number of cases it is semi-deciduous, that is to say, while its presence is obvious, it is not always deciduous.

These "staminiferous rims or rings" are called also "annular rim" and "deciduous rim." (I have occasionally used the term "halo ring.")

Following are the species in which they have been observed:—

E. Dawsoni, figs. 7*a*, 7*b*, Plate 175 (shows well the stamens attached; the ring may be likened to a collar in this species).

As a rule, one notices this deciduous ring better in the fruit, for example—

E. affinis, Figs, 3*d*, 5, 6, 7, Plate 57.
E. Behriana, Fig. 6*d*, Plate 48.
E. Beyeri, Fig. 3*c*, Plate 199.
E. bicolor, Fig. 5*d*, Plate 49.
E. Bosistoana, Figs. 2*b*, 4*f*, Plate 49.
E. Caleyi, Fig. 13*f*, Plate 56.
E. crebra, Fig. 9, Plate 53.
E. diversicolor, Figs. 11 and 12, Plate 86.
E. diversifolia, Part XXXIII, p. 86.
E. eremophila, Figs. 7*d* and 10, Plate 149.
E. grossa, Fig. 1*a*, Plate 72.
E. Guilfoylei, Figs. 3*a*, 3*b* and 4, Plate 87.
E. hemiphloia, Figs. 4 and 5, Plate 50.
E. leucoxylon, Fig. 8, Plate 56.
E. melliodora, Figs. 1*c*, 8*b*, Plate 61.
E. paniculata, Figs. 14, 15, Plate 57, and 1*d*, Plate 196.
E. patens, Fig. 4, Plate 88.
E. polyanthemos, Figs. 7*c*, 10*c*, 10*d*, Plate 58 *and* 3*b*, Plate 59.
E. pruinosa, Fig. 7*a*, Plate 54 (so labelled, but it is really *E. Shirleyi*).
E. Shirleyi, see *E. pruinosa*.
E. sideroxylon, Fig. 12, Plate 55.
E. Websteriana, Fig. 4*b*, Plate 143.

See also the Eudesmieæ, under the caption "Bundling or Tuftiness of the Stamens," at p. 37.

In *E. Bakeri* the stamens may be persistent on the ring even as long as the valves are extruded, so that we may have ripe fruit and stamens together.

So far as I can see, botanists rarely refer to this deciduous rim, and then only in connection with the fruit, as its presence can be easiest seen in that stage.

Mueller refers to "Rim of the young fruit encircled inside by a flat annular membrane" (*i.e.*, staminal ring), (*E. siderophloia*, "Eucalyptographia," which I suggest may be a slip of the pen for *E. sideroxylon*).

There is some correlation, but not a marked one, between species with marked annular rings, and the Terminales, *e.g.*, *E. sideroxylon*, *E. leucoxylon*, *E. Calleyi*, *E. Dawsoni*.

(*b*) *Discontinuous.*

Bundling or Tuftiness of the Stamens (Eudesmieæ).

Robert Brown ("Appendix to Flinders' Voyage," II, 599, t. 3) proposed to establish the genus *Eudesmia*, as separate from *Eucalyptus*, partly by reason of the arrangement of the stamens indicated above. Under *E. erythrocorys*, Part XLV, p. 135, with figures, I have, I think, sufficiently explained the arrangement.

Bentham makes reference to what I have called the Bundling or Tuftiness of the stamens in the case of the following three species. He calls the group which includes them the Eudesmieæ.

Stamens . . . forming 4 bundles alternating with the calyx-teeth, the claw or entire part very short and broad, or four clusters, if the claw be considered as a mere dilatation or lobe of the margin of the staminal disk. (*E. erythrocorys.*)

Stamens . . . more or less distinctly arranged in four clusters or bundles, alternating with the calyx-tube, but the claws or dilatations of the disk very short or scarcely perceptible . . . . (*E. tetragona.*)

Stamens . . . distinctly arranged in four clusters or bundles alternating with the calyx teeth . . . (*E. eudesmioides.*)

Mueller remarks—

E. tetragona shares with *E. erythrocorys* the remarkable characteristic of having its stamens united into bundles, which alternate with the teeth of the calyx, though the filaments do not actually unite, but are inserted on semiorbicular lobes, different in colour and consistence. On this distinction rests R. Brown's genus *Eudesmia*, which to some extent holds the same position towards *Eucalyptus* as *Melaleuca* towards *Callistemon*, and as *Tristania* towards *Metrosideros*; the coalescence of the filaments of *Melaleuca* is one of degree only, and even in the typical *M. Leucadendron* affects merely the very base of the staminal bundles. But as in all three hitherto known Eudesmias, hardly any concrescence of the filaments themselves is traceable, I deemed it best to include them in the genus Eucalyptus, especially as calyx-teeth are still more strongly developed in *E. odontocarpa* and *E. tetrodonta*. ("Eucalyptographia," under *E. tetragona.*)

In the Eudesmiæ (except *E. tetrodonta*) the four depressions are where the stamens are, or have been inserted.

I will content myself with some references, in the present Part, and it will be seen that the attachment of the stamens is to a deciduous, white, undulating staminal ring, the stamens not continuous as in the non-Eudesmieæ, but broken because of the tuftiness already alluded to.

E. erythrocorys; see Part XLV, article " Bundling and Tuftiness of the Stamens," at p. 135, and figs. 2*d* and 2*g*, Plate 184.)

Two characters may arise from the undulations in the Eudesmieæ--

(*a*) The width of the staminal ring may be greater at the crests or tops of each undulation, becoming narrowest in each trough. (See fig. 2*d*, Plate 184.)

(*b*) The lengths of the filaments vary, the longest emerging from the crests of each undulation. (See Part XLV, p. 135.)

E. eudesmioides. See Part XLV, p. 136; Part XLVI, p. 165.

E. tetragona. See Part XLV, p. 136; Part XLVI, p. 163.

E. tetrodonta.—It is expedient to again refer to this species in connection with figs. 2 and 3*a*, Plate 185, and top of page 136, Part XLV. Calyx distinct, as depicted, the lobes prominent, thick, obtuse, free from the operculum at the apex; operculum thin. Staminal ring cylindrical, raised above the undulate calyx lobes. Filaments numerous, slender, attached to the top of the staminal ring in an almost uniform manner, and not in four clearly distinct bundles. That the four bundles are not clearly marked is shown in fig. 3*a*. The undulate calyx-lobes in this species are not to be confused with the undulate staminal ring common in the Eudesmieæ.

E. Baileyana. See Part XLIV, p. 113; Part XLV, p. 136.

DISC OF THE FLOWER.

Historical.

Bentham, 1866.

Mueller, 1879-84.

Following are the species in which Bentham refers to the disc, so far as the stamens are concerned, but I cannot trace where he gives a definition of the disc:—

E. macrocarpa. " Their insertion (stamens) raised to about 2 lines above the edge of the calyx by the thick edge of the disc, which is also often slightly raised within the stamens in a ring round the ovary." (B.Fl., iii, 224.)

E. globulus. " Stamens . . . raised above the calyx by the thick edge of the disc." (*Ib.*, 225.

E. pyriformis. "Disc very broad, forming within the stamens a thick prominent ring round the depressed top of the ovary." (*Ib.*, 226.)

E. conoidea (*erythronema*). "Stamens . . . raised by the thick disc ½ to 1 line above the border of the calyx." (*Ib.*, 227.)

E. robusta. "Stamens . . . somewhat raised above the calyx-border by the annular margin of the disc." (*Ib.*, 228.)

E. Preissiana. "Disc broad and concave, the ovary with as many protuberances in the centre as valves." (*Ib.*, 232.)

E. annulata. ". . . the margin of the disc that bears them (stamens) forming a raised inflexed ring about ¾ line broad." (*Ib.*, 234.)

E. spathulata Hook. ". . . the border of the staminal disc inflected over the sunk ovary. . . ." (*Ib.* 236.)

E. pachyloma. "Disc concave." (*Ib.* 237.)

E. Oldfieldii. "Disc forming a more or less raised ring within the stamens round the flat-topped ovary." (*Ib.*, 237.)

E. Drummondii. "Disc very broad, nearly flat, forming a prominent ring round the ovary, of which the obtusely conical centre protrudes about 1 or 1½ lines above the disc at the time of flowering." (*Ib.*, 237.)

E. orbifolia. "Disc narrow round the conical summit of the ovary, which protrudes 3 or 4 lines above the border of the calyx, tapering into the short thick style." (*Ib.*, 238.)

E. resinifera. "Stamens . . . raised above the calyx-border by the disc. (*Ib.*, 245.)

E. pellita. "Stamens . . . somewhat raised above the calyx-border of the disc." (*Ib.*, 246.)

Mueller ("Eucalyptographia") uses the term "staminiferous disc" (under *E. occidentalis*). He also uses the terms "discal summit" and "discal portion, &c." (See Part LX, p. 604.)

DISC OF THE FRUIT.

In the definition of the genus, Bentham says—

"Fruit . . . the persistent disc usually thin and lining the orifice of the calyx-tube when the capsule is deeply sunk; concave, horizontal, convex, or conically projecting, and more or less contracting the orifice when the capsule in not much shorter than, as long as, or longer than the calyx-tube; the capsule always adnate, &c." (B. Fl. III, 185.)

E. pachyphylla and *E. Oldfieldii.* "Disk forming a raised ring or prominent rim. . . ." (*Ib.*, 196.)

E. pachyloma, E. Drummondii, and *E. orbifolia.* "Disk concave in the flower, very convex in the fruit. . . ." (*Ib.*, 196.)

E. macrocarpa. Bentham says, "the very broad disk forming a raised rim." (*Ib.*, 224.)

E. globulus. He uses the terms "flat-topped 'disk' or 'rim.'" (*Ib.*, 225.)

E. pyriformis. He refers to the ring formed by the "disk." (*Ib.*, 226.)

He uses the term "disk" in the sense of "rim" under *erythrocorys*, see p.

Mueller, in the definition of the genus (" Eucalyptographia ") says—

". . . discal space intervening between the (inner, J.H.M.) edge of the calyx and the base of the valves from narrow to very broad in different species, and not seldom protruding."

". . . discal expansion forming a narrow rim beyond the calyx-teeth." (Specific description of *E. tetrodonta*.)

". . . discal lining generally much extended beyond the ovary." (Generic definition of Eucalyptus—" Eucalyptographia.")

The following are synonyms:—

Discal-lining.
Floral disc (flower).
Capsular disc (fruit).

Let us begin with some preliminary observations.

Disc or Discal-lining. In *E. Preissiana*, *E. megacarpa*, *E. globulus*, and *E. alpina*, which we take as examples, the thick band or expansion at the top of the fruit is an enlargement of the floral disc. Its development in the fruit or capsule can be traced from the floral stage. In all species examined it varies somewhat, but its presence, as far as I have observed, is indicated by the usually dark zone or lining at the base of and on the sides of the calyx-tube. In the species mentioned, the pulvinate gland-like processes are present on the floral disc, and as the ovary develops, so also does the disc. As the ovary develops, it grows upwards and outwards, and apparently more so in the centre, until it is carried, with the disc, beyond the level of the calycine rim. The rim then increases in thickness, and at the same time gradually extends over the valves of the capsule, but in all cases leaves the tips of the valves free. In *E. Preissiana* the disc is entirely free from the valves, and forms a thick crenate layer above them on the inner margin, while the outer edge is fused to the calycine portion of the capsule. The disc therefore derives its nutriment from the calycine portion, and not from any portion of the valves or ovary.

The term " discal-lining " applied by Mueller to some species is a very appropriate one, for in the species mentioned the calyx-tube cup is deep, and has a dark carnose lining which extends towards the ovary in a wave or crenate line, and is differentiated from the ovary by the colour, that of the latter organ being always much paler. The discal lining is naturally more noticeable in species with large flowers and fruits. The term could be conveniently used in descriptions when the disc is obscure, because it is, like the disc, an important character, as it is very largely responsible for the morphosis of the fruit.

EXPLANATION OF PLATES 248–251.

PLATE 248.

Bracts and Bracteoles.

1A. (*a*) Bracts (there are up to three, fused at the edges, to each bud), enveloping the single bud. Where the pedicels are attached to the peduncle, the scar of the more inclusive bracts which envelop the umbel will also be seen.

1B. Bract at base of pedicel enveloping the entire umbel, of which only one bud is shown.

1C. Plan of a bud and bracts (1A (*a*)), the bracts surrounding the bud (*b*). All are from *E. pyriformis* Turcz. var. *elongata*, cultivated in Botanic Gardens, Sydney (W. F. Blakely, December, 1917).

2A. Twig of *E. Camfieldi* Maiden, showing leaves and undeveloped umbels.

2B. Umbel, enlarged, showing (*a*) bracts, enveloping the buds. From the type locality of *E. Camfieldi*, viz., about 100 yards south of the 17 mile-post, Galston-road, Hornsby, Sydney (W. F. Blakely and D. W. C. Shiress).

3A. Immature buds, somewhat irregular in contour, of *E. de Beuzevillei* Maiden.

3B. Young umbel, showing enveloping bracts, still fused by their edges. Same species, and all specimens from the type locality (W. A. W. de Beuzeville).

4. Enveloping bracts, as yet joined together, *E. miniata* A. Cunn., Goody Goody, Western Australia (W. V. Fitzgerald).

5A. An umbel, natural size, showing a bract at (*a*).

5B. The same umbel, greatly enlarged. (*a*) a bract; (*b*) a bracteole. The enclosed buds are shown shaded. Although in the enlarged drawing the bracts have the appearance of being continuous with the flattened peduncle, this is really not so, for at an early stage the bracts wither, and, being articulated to the peduncle, drop off. *E. pyrophora* Benth., Saxby River, Northern Queensland (Miss Florence Sulman). See Part LVIII, p. 465.

6A. Buds with enveloping bracts (*a*).

6B. The enveloping bracts, with the buds removed.

6C. Enveloping bract, much enlarged. *E. tetrodonta* F.v.M. All Darwin, Northern Territory (Prof. W. Baldwin Spencer, 1911).

These bracts are in pairs, more or less persistent, confluent with the peduncle, broad lanceolate to navicular, concave, thick, slightly keeled, the margins uniting, subperfoliate, 5–8 mm. long, 3–5 mm. broad. They are not unlike the bracts of some of the Loranthaceæ. Enlargement concave and hooded, superposed by a strong solid apicular process which is also slightly concave. The lower or larger cavity appears to be the impression caused by the outer bud; the smaller upper cavity represents the impression of the top of the central bud, which is usually longer than the lateral or outer buds. It would appear that in the early stage the bracts enveloped the three buds, are free at the apex, and the apicular portion is a protection for the lower part of the bract.

7A. Umbel, natural size, of *E. ficifolia* F.v.M., showing subtending bract.

7B. Umbel, natural size, showing bracts (*a*) and bracteoles (*b*).

7C. Showing the bracts (*a*) and bracteoles (*b*) in plan.

7D. Umbel, natural size, showing bracts (*a*) and bracteoles (*b*).

7A, 7B, and 7D show progressive stages of development of the buds. Note that the opercula in 7B and 7D show more or less clearly where a second operculum has fallen off from each bud. All the above from *E. ficifolia*, cultivated in the Botanic Gardens, Sydney.

7E. Showing two bracts, *E. calophylla*, cultivated in the Botanic Gardens, Sydney.

Membranes of Bud.

8. (*a*) Calyx-tube.
   (*b*) Inner operculum (No. 2).
   (*c*) Outer operculum (No. 1).
   (*d*) Fragments of an outer scurfy layer.
   (*e*) External membrane of the calyx-tube.
   (*c*) and (*e*) appear to correspond, so do also (*a*) and (*b*). (All of *E. eximia* Schauer.)

The membranes covering the calyx-tube and operculum in *E. eximia* appear to consist of the outer coverings of both organs. Each membrane is of such a tough, gelatinous-like nature that it can be separated without laceration.

If (*c*), the outer operculum, is of calycine origin, then what about (*e*), which is obviously of similar origin? It seems to me that they both represent the calyx, and we have a key to the position in the Hinged Operculum (see Part LVIII, p. 492), where, in numerous species of the Corymbosæ, it is shown that in what corresponds to (*c*) and (*e*) there is a tearing, in other words, there is an indication of some continuity between them. In the present case there is a sharp line of demarcation between (*c*) and (*e*), but this must not be relied upon too much, as there is occasionally a fusion (and consequently a tearing) of (*c*) and (*e*) in *E. eximia* also.

Scurfiness.—The minute dark patches (*d*) on the outer membrane or outer operculum are due to a scurfy substance which more or less envelops the young buds and is not uncommon in the Corymbosæ. It is therefore present on the calyx as well as the operculum.

We have a somewhat similar condition in *E. terminalis*, except that, in the latter species, the scurfiness is more persistent, and also in *E. corymbosa*, where there is a note on "Scurfiness of Fruits," at Part XXXIX, p. 243.

The Operculum (double, solid and hinged).

9A. (*a*) Outer operculum (of an amber colour when fresh);
   (*b*) Inner operculum (of a green colour when fresh).
   E. maculata Hook. f. See also Part LVIII, p. 489. When the outer operculum is cast in this species, the inner one is seen to be smooth and shining; in this character it appears to differ from all other species.

10. Showing the operculum, a little pyramidal cap, which has ceased to grow, and which is gradually pushed off by the expanding stamens. *E. tetraptera* Turcz., cultivated in the Botanic Gardens, Sydney.

11A. Side or oblique view of fleshy operculum.

11B. Longitudinal section of the same. Note the increasing thickness as the apex is approached, and also the cavity which serves to enclose the stigma and the upper part of the style.

11C. The same, looked at from above; the mould-like cavity for the stigma is seen as a small inner circle. *E. macrocarpa* Hook., cultivated in the Botanic Gardens, Sydney, 13th August, 1917.

12A. External view of operculum.

12B. Oblique view of operculum.

Note how fleshy it is. At the centre of the inside of the operculum (*i.e.*, at the top of the operculum) is a cavity which encloses the stigma and the top of the style. In the lithograph, this cavity is not as clear as in the original. It is not as deep as in *E. macrocarpa*, as may be readily inferred from the greater length of the umbo in this species. *E. pyriformis* Turcz., Mullewa, Western Australia (C. E. Chapman, October, 1919. It had shrunk a little when I received it).

13A. The winged, solid calyx-tube, which is orange-scarlet in colour. Note the slightly protruding stigma.

13B. The almost solid operculum, square, with rounded corners at the base. Note the deeper shaded circle in the centre, which indicates the sheath for the top of the style and of the stigma. *E. tetraptera* Turcz., cultivated in the Botanic Gardens, Sydney, 17th September, 1919.

This method of protection of the stigma has been shown in three conspicuous instances. It is, however, probable that in Eucalyptus the stigma is protected in a similar manner in all or most cases, though it is obvious that in very small or thin opercula it would not be readily seen.

14. Flowers showing the persistent operculum. *E. hæmatoxylon* Maiden, cultivated Botanic Gardens, Sydney.

15. Flower showing the persistent operculum. *E. ficifolia* F.v.M., cultivated Botanic Gardens, Sydney. The same has also been observed in *E. calophylla* R.Br.

In these cases (and it has been observed in other species, see Part LVIII, p. 492), it will be observed that the calyx-tube has continued to grow, leaving the operculum in arrested development, adherent to the calyx-tube in the manner of a hinge.

Sepals and Petals.

16. Comparatively young buds of *E. tetragona* F.v.M., showing oil-glands (dots) and also faint lines of demarcation indicating the margins of petals. Lynburn, Alexander River, Western Australia (H. P. Turnbull).

17. This calyx indicates clearly the partial division into sepals (*E. tetradonta* F.v.M., Port Darwin, Northern Territory, Nicholas Holtze). It shows a bud free from insect action, and the raised tubular staminal ring behind the sepals. We have in this specimen something more than "a distinctly toothed calyx," as originally remarked by Robert Brown.

E. tetradonta F.v.M., Bathurst Island, G. F. Hill, No. 466. See figs. 18A, 18B, being plan and elevation of a bud. (Compare also figs. 2 and 3*a*, Plate 185, Part XLV.)

Figs. 18A and 18B represent a bud attacked internally by insects, but externally they clearly demonstrate certain morphological characters. They not only show the young calyx separated into its sepals, but also the petals fused into an operculum. The four petals are partly united, but not perfectly so, for the demarcation lines are still present, which indicate the original line of cleavage of the petals before metamorphosis took place. This seems to indicate that at one time the petals of this species were free and valvate in the bud, with a thickened keel or raised line down the centre, but somewhat thicker towards the top. (I am aware that in the Myrtaceæ the petals are very much imbricate in the bud. It may be that in the process of fusion of the petals the overlapping or imbrication has become obliterated, or is represented only by a thickening.)

The buds at this stage also show the sutural line of the operculum, which indicates that the petals were deciduous in a very early state.

Raised lines indicating the shape of the opercula are to be seen in at least two other species of the Eudesmieæ, *e.g.*, *E. erythrocorys*, fig. 2*f*, Plate 184. See also its presence in *E. tetragona*, as shown in fig. 16. Operculum fairly thin, hemispherical, copiously dotted with somewhat prominent oil-glands, and marked by four very fine lines which are sometimes only discernible with the aid of a lens, but often are much more distinct.

The less closely-related *E. pyriformis* also shows these raised lines, *e.g.*, figs. 1*b*, 4*c*, Plate 75, and figs. 1*d*, 4*b*, Plate 76. In these cases, although there are more than four ribs, there are four principal ribs. See also fig. 6*a*, Plate 75, of *E. pyriformis* var. *minor*, which is *E. pachyphylla*, as shown in Part XLI, figs. 1–3, Plate 171.

Although in the previous examples we have been dealing with the evidence of petals in the operculum, it is proper to suggest that, in some cases, the ribs or wings in the calyx-tubes indicate the lines of demarcation of sepals. For example :—

"*Eudesmia* (*tetragona*) . . . differs from Eucalyptus solely in having a striated operculum placed within a distinctly toothed calyx, and in its filaments being collected into bundles. The operculum in Eudesmia, from the nature of its striæ, and their relation to the teeth of the calyx, appears to be formed of the confluent petals only; whereas that of Eucalyptus, which is neither striated nor placed within a distinct calyx, is more probably composed, in several cases at least, of both floral envelopes united. . . ." (Robert Brown, in "Flinders's Voyage," 1814.)

In Part LVIII I promised to discuss the above two sentences when a figure or figures of operculum were available, and when discussing the affinities of the Eudesmieæ.

19A. Longitudinal section of a nearly expanded bud of *E. tetragona* F.v.M., Stirling Range, Western Australia, showing inflection of the filaments, ovules, and top of ovary.

19B is the operculum of the same, and 19B (*b*) and 19A (*a*) are the same organ. (See also fig. 16.)

The inside of the operculum is more or less striate, and a small cleft, compressed or angular, stipes-like attachment projects from the centre of the top.

If a longitudinal section of a bud is made, this stipes-like appendage is seen to project downward towards the style, and sometimes it exceeds that organ. When it is longer than the point (stigma) of the style, the latter is seen to grow to one side, as it were, to allow the projection to pass down towards the base of the style. Or it may be that the stalk-like appendage is of much harder substance than the style, and in that case the style is forced to bend when it comes in contact with it.

This appendage is rarely seen, and requires investigation. In the bud-section its presence seems to accentuate the division of the operculum into four petals, and the "appendage" may be of the nature of a stipes or claw.

PLATE 249.

ANTHERS.

A. Renantheræ.

1A. Renantheræ (normal). (See Part LIX, p. 525).

1B. Subseries Alpinæ. (See p. 526.)

1C. Subseries Brachyandræ. (See p. 527.)

1D. Anthers of *E. Guilfoylei* Maiden, which open very widely and have the appearance of the wings of a butterfly. (See p. 528.)

B. Renantheroideæ.

2. Renantheroideæ. (See p. 528.)

C. Porantheroideæ.

3. Porantheroideæ. (See p. 529.)

D. Terminales.

4. Terminales. Note the anther erect on the filament, and oblique on the filament. There is often absence of the gland in the Terminales. (See p. 530.)

E. Platyantheræ.

5A. Platyantheræ, of which the anthers of *E. oleosa* may be taken as a type. (See p. 532.)
5B. Subseries Graciles. (See p. 533.)
5C. Subseries Pyriformes. (See p. 533.)

F. Macrantheræ.

6A. Subseries (1) Tereticornes. (See p. 533.)
6B. Subseries (2) Longiores. (See p. 535.)
6C. Anthers of *E. miniata* and *E. phœnicea*. (See p. 535.)
6D. Anthers of *E. salubris* and *E. Campaspe*. (See p. 536.)
6E. *E. calophylla*. Note the tapering of the filament at the connective, and thickening towards the base. This also shows a specimen of a versatile anther. All anthers may be versatile except Terminales and Porantheroideæ.
6F. Globular anther—parallel slits. Eudesmieæ (*E. erythrocorys*). (See p. 536.)

6G. Versatile anther with large gland, *E. goniantha*. One of the miscellaneous anthers indicated at top of p. 535.

6H. Anther of *E. diversicolor*. (See "Miscellaneous," top of p. 535.) This bears considerable affinity to fig. 2 (Renantheroideæ), but seems to be anomalous, and may therefore be kept apart for further information.

Lack of Uniformity.—We must be careful not to suggest uniformity where it is non-existent. It may be that we have only one specimen of a particular species, and, if other specimens were found, the anthers would probably show some lack of uniformity. Indeed, in some common species it becomes difficult to say what one would adopt as the typical form of the anther. This is but an additional instance of the fact that all the organs of a species vary within limits—that variation is a grand law of Nature.

Gland.—In judging an immature anther, it is always the case that the gland is rather large, and as growth progresses it becomes less in size, as if its partial absorption were necessary for the development of the anther. I have briefly referred to the matter under *E. Shirleyi*, Part LVIII, p. 425.

Size.—In exhibiting a series of comparative drawings of anthers, one must be careful to remember that they vary a good deal in size. Indeed, some are so small that a life-size drawing would be of little value to the person of average eyesight.

Inflection of Stamens.

I have omitted illustrations in the present work, as Mueller has so freely shown them in his longitudinal sections of the flower buds throughout the "Eucalyptographia." (See also the statements in Part LIX, p. 546.)

These two drawings, Nos. 7 and 8 (see also 19A, Plate 248), are intended more as a reminder than anything else.

7 is *E. tetraptera* Turcz., and

8 is *E. erythrocorys* F.v.M., both cultivated Botanic Gardens, Sydney, 10th July, 1922.

7A is the wing of the calyx-tube and bud generally, and

7B is the wall of the bud generally.

In both figures, note that the stamens in the bud are inflected from the stigma. Notice also the section through the ovary, and the curve of the top of the ovary.

Style and Stigma.

9. From left to right, here are shown stigmas of *E. terminalis* F.v.M. (Darwin), two drawings showing papillæ round the edge of the stigma, and *E. tetrodonta* F.v.M. (Darwin) two. It is very difficult to show differences in stigmas, other than those exhibiting an enlargement (as compared with the stigma), and those practically of the same diameter as the style. The styles vary in length of course. The young stigma of *E. ptychocarpa* from an unopened bud has been found to be square in shape.

Evolution of the Disc.

10A–10E. *E. tereticornis* Sm. Floral disc conspicuous, forming a distinct dark, carnose, raised ring of 2–3 mm. around the base of the conical ovary, or projecting well beyond the staminal ring. Capsular disc broad, domed, exceeding the calyx-rim by 3–4 mm.

E. tereticornis, five figures (all enlarged) to illustrate the evolution of the adnate disc.
(All from Outer Domain, Sydney.)

10A. (*a*) Calyx-tube.
(*b*) Calyx-rim.
(*c*) Staminal ring.
(*d*) Floral disc.
(*e*) Ovary.

10B. (*a*) Calyx-tube.
(*b*) Calyx-rim.
(*c*) Staminal ring.
(*d*) Floral disc, more advanced than in Fig. 10A.
(*e*) Ovary.
(*f*) Base of style.

10C. (*a*) Calyx-tube.
(*b*) Calyx-rim.
(*c*) Staminal ring.
(*d*) Floral disc, more advanced than in Fig. 10B.
(*e*) Half-developed ovary.
(*f*) Base of style.

10D. (Showing capsular disc)—
(*a*) Calyx-tube.
(*b*) Calyx-rim.
(*c*) Staminal ring.
(*d*) Capsular disc.
(*e*) Valves of the capsule.

10E. (Showing capsular disc)—
(*a*) Calyx-tube.
(*b*) Calyx-rim.
(*c*) Staminal ring.
(*d*) Capsular disc.
(*e*) Valves of the capsule.

It will be observed from the figures that the floral disc changes (evolves) into the capsular disc; in other words, there is no fixed line between them. The evolution of the calyx can be traced in the same way.

PLATE 250.

The Disc.

E. pyriformis Turcz, var. *Kingsmilli* Maiden (1A to 1E, of which 1E is alone of natural size).

1A. Longitudinal section of flower.
(*a*) Calyx-tube with wing.
(*b*) Calyx-rim.
(*b*1) Thickness of calyx-tube.
(*c*) Staminal ring.
(*d*) Nectary trough between the staminal ring and the floral disc.
(*e*) Floral disc.
(*f*) A deep nectary between the ovary and the floral disc.
(*g*) Ovary and style.
(*h*) Ovary.

1B. A very young fruit.
(*a*) Calyx (calyx-tube) showing prominent ribs.
(*b*) Calyx-rim.
(*b*1) Thickness of calyx-tube.
(*c*) Torn membranous lining of the lower edge of the operculum.
(*d*) Staminal ring.
(*e*) Outer nectary (between the inner edge of the staminal ring and the disc).
(*f*) Floral disc.
(*g*) Inner nectary, surrounding the ovary.
(*h*) Ovary and style.

1C. Transverse section of base of style.

1D. Fruit (enlarged).
- (*a*) Calyx-tube, with its prominent ridges or wings.
- (*b*) Calyx-rim.
- (*b*1) Thickness of calyx.
- (*c*) Staminal ring.
- (*d*) Capsular disc.
- (*e*) Valves of the capsule (all drawn from the type).

1E. Fruit, natural size, for comparison with the above enlarged drawings.
(Near Mount Keith, north of Leonora, Western Australia, Hon. W. Kingsmill, M.L.C.)

E. pyriformis Turcz.

2A. (*a*) Calyx-tube, winged.
- (*b*) Calyx-rim.
- (*b*1) Thickness of calyx-tube.
- (*c*) Staminal ring.
- (*c*1) Stamens.
- (*d*) Floral disc.
- (*e*) Ovary and style (pistil).

2B. (*a*) Calyx-tube. Ridges of the calyx.
- (*b*) Calyx-rim.
- (*b*1) Thickness of calyx-tube.
- (*c*) Staminal ring.
- (*d*) Floral disc, with impressions left by stamens.
- (*e*) Ovary and style. The dark spots are the impressions of the anthers around the base of the raised ovary.

2C. Fruit (showing capsular disc).
- (*a*) Calyx-tube, showing prominent ribs.
- (*b*) Calyx-rim.
- (*b*1) The thickness of the calyx-tube supporting operculum.
- (*c*) Staminal ring.
- (*d*) Capsular disc.
- (*e*) Valves of the capsule.

(Ooldea, north of Fowler's Bay, South Australia, Henry Deane.)

E. macrocarpa Hook. Floral disc forming a broad, slightly raised ring around the base of the ovary, and some distance from it, the upper surface of the disc more or less distinctly marked by the impression of the bases of the filaments, the inner edge sharp, slightly concave, lower than the centre of the ovary and staminal ring, so that a shallow nectary trough is formed around the ovary.

Capsular disc prominent, thick, more or less oblique, or in perfect specimens rounded or domed, exceeding the staminal rings by about 10 mm.

3A. (*a*) Calyx-tube.
- (*b*) Calyx-rim.
- (*b*1) Thickness of calyx.
- (*c*) Staminal ring.
- (*d*) Capsular disc.
- (*e*) Valves of the capsule.

3B. Longitudinal section of fruit.
- (*a*) Calyx-tube.
- (*b*) Thickness of calyx.
- (*c*) Carpels.
- (*d*) Cell.
- (*e*) Placenta.
- (*f*) Placental column.

3c. Transverse section of fruit.
(*a*) Rim of calyx-tube.
(*b*) Thickness of calyx.
(*c*) Cell.
(*d*) Placenta.

3d. Longitudinal section of fruit.
(*a*) Rim of calyx-tube.
(*b*) Carpels.
(*c*) Cell.
(*d*) Placental column.

3e. A deep transverse section of the fruit.
(*a*) Rim of calyx-tube.
(*b*) Thickness of calyx-tube.
(*c*) Cell.
(*d*) Placental column.

(Plains north-east from New Norcia, Western Australia, Dr. A. Morrison.)

PLATE 251.

The Disc (*continued*).

E. erythrocorys F.v.M. Floral disc thick, dark green, fleshy, forming a raised wheel-like design over the top of the ovary, from the circular portion four spoke-like ridges of the same thickness as the circular portion project into the calyx-tube, midway between the calyx-teeth, and form supports for the calyx lobes or the undulating staminal ring.

1a. (*a*) Calyx-tube (showing ribs).
(*b*) Tooth of the calyx (of which there are four) or rudimentary sepals.
(*c*) Calyx-rim.
(*d*) Undulating staminal ring attached to the rudimentary petals.
(*e*) Ridge supporting the rudimentary petal.
(*f*) Circular floral disc over the top of the ovary.
(*g*) One of the four trough-like nectaries outside the floral disc.
(*h*) Top of ovary and nectary inside floral disc. The base of the style is also shown.

1b. Longitudinal section of fruit.
(*a*) Calyx-tube.
(*b*) Thickness of calyx-tube.
(*c*) Thick placental column.
(*d*) Cell.

1c. Transverse section of fruit.
(*a*) Edge of the ribbed calyx-tube.
(*b*) Thickness of the calyx-tube.
(*c*) Cell.

(Dongarra, Western Australia, W. D. Campbell.)

E. Baileyana F.v.M.

2. Longitudinal section of fruit.
(*a*) Calyx-tube.
(*b*) Thickness of calyx-tube.
(*c*) Carpels.
(*d*) Cell.
(*e*) Placental column.

(Eight-mile Plains, near Brisbane, F. M. Bailey.)

E. tetrodonta F.v.M. Floral disc more or less prominent, forming a dark carnose covering over the top of the conical ovary, almost up to the base of the style, and projecting in the thickish ridges over the centre of the embryonic valves of the ovary, and thus forming three or more distinct ovarian nectaries. Capsular disc forming a small dark carnose ridge over the centre of the valves as in the floral disc, and considerably lower than the staminal ring, which remains conspicuous on the ripe capsule. (No figure given of disc of *E. tetrodonta* at this place.)

E. tetraptera Turcz.

3A. Longitudinal section of fruit.
- (*a*) Calyx-tube.
- (*b*) Thickness of calyx-tube.
- (*c*) Cell.
- (*d*) Discal lining.
- (*e*) Top of carpel.
- (*f*) Edge of carpel.
- (*g*) Placental column.

3B. Transverse section of fruit.
- (*a*) Calyx-tube.
- (*b*) Thickness of calyx-tube.
- (*c*) Cell.
- (*e*) Placenta.
- (*f*) Wing of the calyx.

(Both near Cape Riche, Western Australia, W. Dunn.)

E. tetragona F.v.M.

4A. Longitudinal section of fruit.
- (*a*) Calyx-tube.
- (*b*) Cells.
- (*c*) Top of the carpels.
- (*d*) Ovary.

4B. Transverse section of fruit.
- (*a*) Rim of calyx-tube.
- (*b*) Thickness of calyx.
- (*c*) Cell.

(Both Bremer Bay, Western Australia, J. Wellstead.)

E. Watsoniana F.v.M.

5A. (*a*) Calyx-tube.
- (*b*) Thin jagged membrane or inner lining of the operculum, which becomes detached from the lower inner edge, as the operculum falls off. (Same as 1B (*c*), in *E. pyriformis* var. *Kingsmilli*.)

5B. Operculum from the inside. Note the thick texture.

(Delubra, Mundubbera, Queensland, H. S. Bloxsome.)

E. Oldfieldi F.v.M. Floral disc forming a short tubular raised disc above the base of the ovary and top of the calyx and about 2 to 3 mm. from the staminal ring. Staminal ring slightly raised above the top of the calyx, so that a shallow trough-like nectary is formed. The deeper hollow cavity around the top of the ovary would also serve as a reservoir for nectar. Capsular disc thick, semiconical (resembling the lower half of a cone), truncate, exceeding the calyx-rim by 4–5 mm. The morphosis of the disc from the flowering to the fruiting stage in this species is similar to that of *E. pyriformis* and the variety *Kingsmilli*.

6A. Flower with stamens removed.
- (*a*) Calyx-rim.
- (*b*) Staminal ring.
- (*c*) Floral disc.
- (*d*) Ovary and portion of style.

6B. Very young fruit.
- (*a*) Calyx-tube.
- (*b*) Calyx-rim.
- (*c*) Thickness of calyx-tube.
- (*d*) Staminal ring.
- (*e*) Raised floral disc.
- (*f*) Ovary and base of style.

6C. Plan of same.
- (*a*) Calyx-rim.
- (*b*) Thickness of calyx-tube.
- (*c*) Staminal ring.
- (*d*) Floral disc.
- (*e*) Ovary and base of style.

6D. A cluster of fruits—natural size—showing the developed disc.
- (*a*) Calyx-tube.
- (*b*) Rim of calyx-tube.
- (*c*) Prominent disc.
- (*d*) Tips of the slightly exsert valves of the capsule.

(All Minginew, J.H.M.)

E. Drummondi Benth. Floral disc forming a raised ring around the sides of the ovary and partly adnate to it, exceeding the calyx-rim by about 1½mm. Staminal ring indistinguishable from the top of the calyx, and slightly lower than it. A nectar-like trough is formed in this species somewhat similar to that of *E. Oldfieldi*, except that in *E. Drummondi* it is the top of the calyx which is highest, and not the staminal ring. There is also a troughlike cavity around the conical ovary, as in *E. Oldfieldi*, but not nearly so deep, as the ovary is more exsert and cone-like. Capsular disc thick, domed, exceeding the calyx-rim by about 3 mm. The staminal ring which has grown outward is also present on the ripe capsule, and it is higher than the calyx-rim, or top of the calyx of the flower.

7A. Illustrating the floral disc.
- (*a*) Calyx-tube.
- (*b*) Calyx-rim.
- (*c*) Staminal ring.
- (*d*) Inner edge of staminal ring.
- (*e*) Floral disc.
- (*f*) Nectary.
- (*g*) Top of ovary and portion of style. The dark spots are the impressions of the anthers when in bud.

7B. Illustrating the capsular disc.
- (*a*) Calyx-tube.
- (*b*) Line indicating the top of the calyx or outer edge.
- (*c*) The broad band indicates the top and inner edge of the calyx-tube.
- (*d*) Staminal ring.
- (*e*) Prominent capsular disc.
- (*f*) Valves of the capsule.

(Cut Hill, York, Western Australia. O. H. Sargent. No. 266. All enlarged. See Plate 74, figs. 7, 9, 10*b*.

E. pellita F.v.M. Floral disc annular, carnose, purple-brown, slightly exceeding the staminal ring, as in *E. resinifera*. Capsular disc annular, truncate, completely absorbing the staminal ring in some cases, but in others, as in *E. resinifera*, the staminal ring may be present.

8A. Illustrating the floral disc.
- (*a*) Calyx-tube.
- (*b*) Calyx-rim.
- (*b*1) Thickness of calyx-tube.
- (*c*) Raised staminal ring.
- (*d*) Floral disc.
- (*e*) Ovary and portion of the style.

8B. Plan of the top of the flower.
(*a*) Calyx-rim.
(*b*) Thickness of calyx-tube.
(*c*) Staminal ring.
(*d*) Ovary.
(*e*) Base of style.
(Ourimbah State Forest, New South Wales, W. A. W. de Beuzeville.)

8C. Ripe fruit, illustrating capsular disc.
(*a*) Calyx-tube.
(*b*) Line indicating calyx-rim.
(*b*1) Line indicating the inner edge of calyx.
(*c*) Raised staminal ring.
(*d*) Capsular disc.
(*e*) Valves of the capsule.
(Kuranda, North Queensland, Miss Edwards.)

8D. Ripe fruit, illustrating the capsular disc, which is more domed than in 8C.
(*a*) Calyx-tube.
(*b*) Calyx-rim.
(*b*1) Line indicating inner edge of calyx-tube.
(*c*) Capsular disc.
(*d*) Valves of the capsule.
(Wyong, New South Wales, J. L. Boorman.)

E. resinifera Sm. Floral disc annular, carnose, dark purple-brown, projecting a little beyond the staminal ring. Capsular disc annular, truncate, the inner portion more or less sloping towards the valves; staminal ring sometimes absorbed by the disc.

9A. Illustrating the floral disc. (Enlarged.)
(*a*) Calyx-tube.
(*b*) Calyx-rim.
(*b*1) Thickness.
(*c*) Raised staminal ring.
(*d*) Floral disc.
(*e*) Ovary and portion of style.

9B. Longitudinal section of flower, illustrating the floral disc.
(*a*) Calyx-tube.
(*b*) Thickness of calyx-tube.
(*c*) Top of calyx-tube.
(*d*) Staminal ring.
(*e*) Floral disc.
(*f*) Top of ovary.
(*g*) Ovules attached to placenta.
(*h*) Placental column.
(Tintenbar, New South Wales, W. Baeuerlen.)

The following species of Eucalyptus are illustrated in my "Forest Flora of New South Wales"* with larger twigs than is possible in the present work; photographs of the trees are also introduced wherever possible. Details in regard to their economic value, &c., are given at length in that work, which is a popular one. The number of the Part of the Forest Flora is given in brackets :—

acaciodes A. Cunn. (xlviii).
acmenioides Schauer (xxxii).
affinis Deane and Maiden (lvi).
amygdalina Labill. (xvi).
Andrewsi Maiden (xxi).
Baileyana F.v.M. (xxxv).
Bakeri Maiden (lxx).
Baueriana Schauer (lvii).
Baueriana Schauer var. *conica* Maiden (lviii).
Behriana F.v.M. (xlvi).
bicolor A. Cunn. (xliv).
Boormani Deane and Maiden (xlv).
Bosistoana F.v.M. (xliii).
Caleyi Maiden (lv).
capitellata Sm. (xxviii).
conica Deane and Maiden (lviii).
Consideniana Maiden (xxxvi).
coriacea A. Cunn. (xv).
corymbosa Sm. (xii).
crebra F.v.M. (liii).
Dalrympleana Maiden (lxiv).
dives Schauer (xix).
dumosa A. Cunn. (lxv).
eugenioides Sieber (xxix).
fruticetorum F.v.M. (xlii).
gigantea Hook. f. (li).
globulus Labill. (lxvii).
goniocalyx F.v.M. (vi).
hæmastoma Sm. (xxxvii).
hemiphloia F.v.M. (vi).
longifolia Link and Otto (ii).
Luehmanniana F.v.M. (xxvi).
macrorrhyncha F.v.M. (xxvii).
maculata Hook. (vii).
Maideni F.v.M. (lxix).
melanophloia F.v.M. (liv).
melliodora A. Cunn. (ix).
microcorys F.v.M. (xxxviii).
microtheca F.v.M. (lii).
Muelleriana Howitt (xxx).
numerosa Maiden (xvii).
obliqua L'Hérit. (xxii).
ochrophloia F.v.M. (l).
odorata Behr and Schlectendal (xli).
oleosa F.v.M. (lx).
paniculata Sm. (viii).
pilularis Sm. (xxxi).
piperita Sm. (xxxiii).
Planchoniana F.v.M. (xxiv).
polyanthemos Schauer (lix).
populifolia Hook. (xlvii).
propinqua Deane and Maiden (lxi).
punctata DC. (x).
radiata Sieb. as *amygdalina* (xvi).
regnans F.v.M. (xviii).
resinifera Sm. (iii).
robusta Sm. (lxviii).
rostrata Schlecht. (lxii).
rubida Deane and Maiden (xliii).
saligna Sm. (iv).
siderophloia Benth. (xxxix).
sideroxylon A. Cunn. (xiii).
Sieberiana F.v.M. (xxxiv).
Smithii R. T. Baker (lxx).
stellulata Sieb. (xiv).
tereticornis Sm. (xi).
tessellaris F.v.M. (lxvi).
Thozetiana F.v.M. (xlix).
viminalis Labill. (lxiv).
virgata Sieb. (xxv).
vitrea R. T. Baker (xxiii).

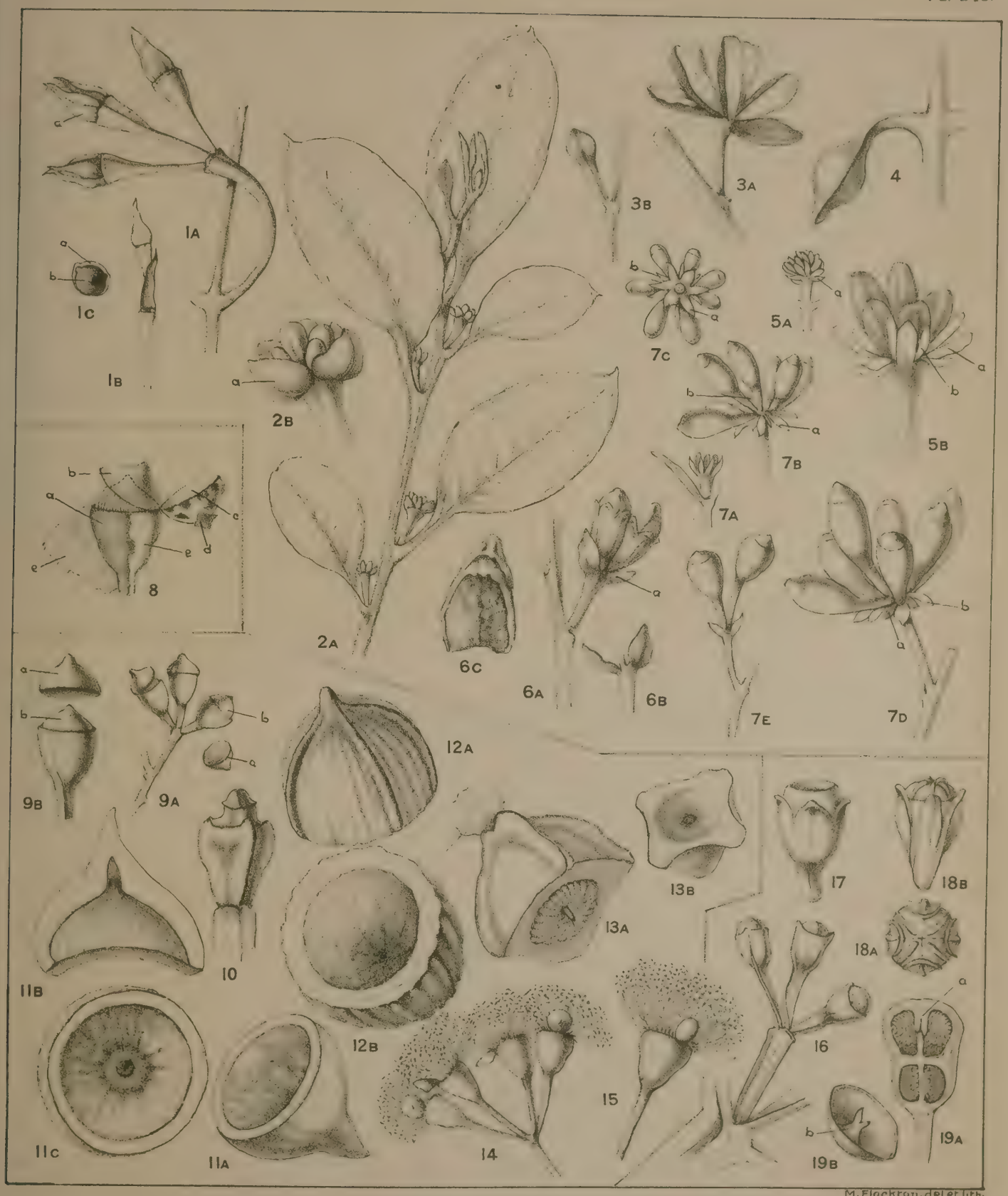
* Government Printer, Sydney. 4to. Each part contains 4 plates and other illustrations.

NOTE BY GOVERNMENT PRINTER.

Financial conditions have so largely affected publications that it is no longer possible to continue the issue of "The Forest Flora of New South Wales" at the old rates, and from this date onward, *i.e.*, from and including Part 7, Vol. VII, the price of the individual Parts will be raised to 2s. 6d. each.

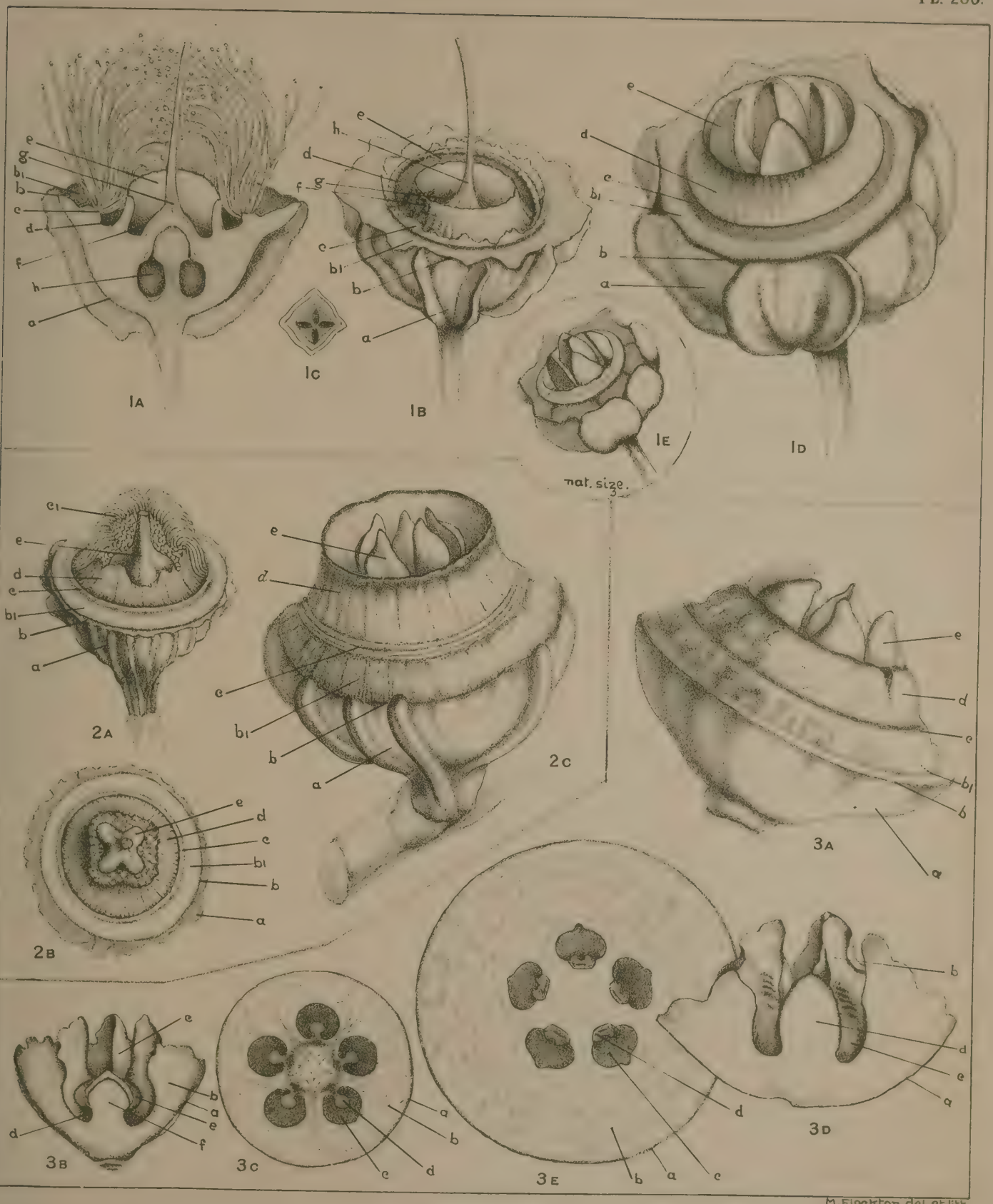
For those Parts already published the old sale price will be adhered to, and subscriptions already received will not be disturbed, but the new subscription rate of 2s. 6d. per part, or 25s. for 12 parts, will come into effect as from the 1st July, 1921.

Sydney: Alfred James Kent, Government Printer—1923.



Bracts and Bracteoles *(1–7)*.
Membranes of Bud *(8)*.
Double, solid and hinged opercula *(9–15)*.
Sepals and Petals *(16–19)*.

A new Anther system (*1–6*). Anthers enlarged.
Inflection of Stamens (*7–8*).
Some Stigmas (*9*). Enlarged.
Evolution of Disc (*10*). E. TERETICORNIS SM. Enlarged.



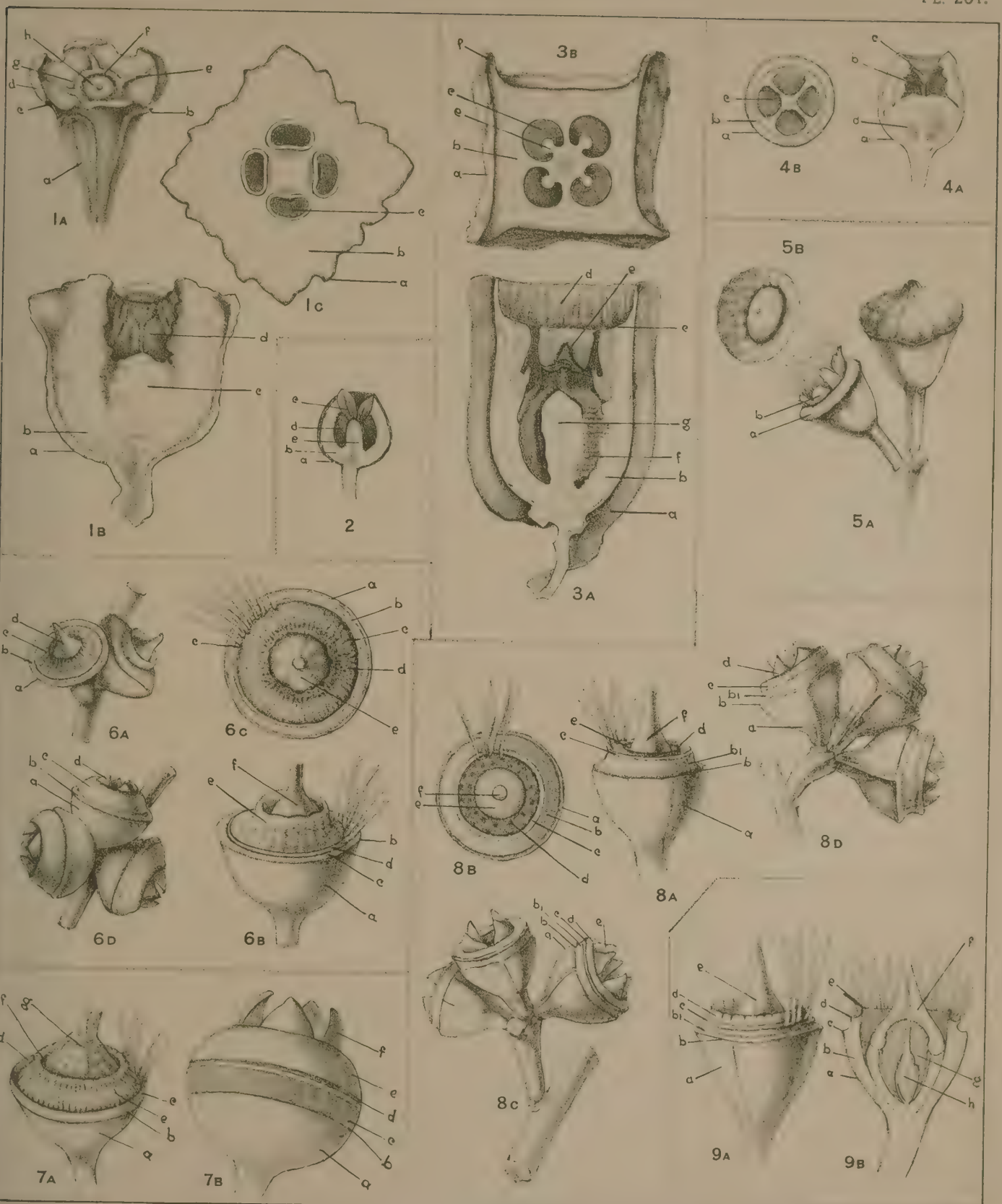
THE DISC.

EUCALYPTUS PYRIFORMIS TURCZ, *var. Kingsmilli* MAIDEN (*1*).

E. PYRIFORMIS TURCZ. (*2*).

E. MACROCARPA HOOK. (*3*).

[All natural size except IA—ID.]



THE DISC—*continued.*

EUCALYPTUS ERYTHROCORYS F.v.M. (*1*).
E. BAILEYANA F.v.M. (*2*).
E. TETRAPTERA Turcz. (*3*).
E. TETRAGONA F.v.M. (*4*).
E. WATSONIANA F.v.M. (*5*).
E. OLDFIELDII F.v.M. (*6*).
E. DRUMMONDII Benth. (*7*).
E. PELLITA F.v.M. (*8*).
E. RESINIFERA Sm. (*9*).

INDEX OF PARTS PUBLISHED—*continued.*

PART XXXI.

tereticornis Smith.
Bancrofti Maiden.
amplifolia Naudin.
Plates, 128-131. (Issued July, 1917.)

PART XXXII.

Seeana Maiden.
exserta F.v.M.
Parramattensis C. Hall.
Blakelyi Maiden.
dealbata A. Cunn.
Morrisii R. T. Baker.
Howittiana F.v.M.
Plates, 132-135. (Issued September, 1917.)

PART XXXIII.

rostrata Schlechtendal.
rudis Endlicher.
Dundasi Maiden.
pachyloma Benth
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PART XXXIV.

reduncа Schauer.
accedens W. V. Fitzgerald.
cornuta Labill.
Websteriana Maiden.
Plates, 140-143. (Issued April, 1918.)

PART XXXV.

Lehmanni Preiss
annulata Benth.
platypus Hooker.
spathulata Hooker.
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argillacea W. V. Fitzgerald.
Plates, 144-147. (Issued August, 1918.)

PART XXXVI.

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macrandra F.v.M.
salubris F.v.M.
cladocalyx F.v.M.
Cooperiana F.v.M.
intertexta R. T. Baker.
confluens (W. V. Fitzgerald) Maiden.
Plates, 148-151. (Issued January, 1919.)

PART XXXVII.

clavigera A. Cunn.
aspera F.v.M.
grandifolia R.Br.
papuana F.v.M.
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PART XXXVIII.

tessellaris F.v.M.
Spenceriana Maiden.
Cliftoniana W. V. Fitzgerald.
setosa Schauer.
ferruginea Schauer.
Moorei Maiden and Cambage
dumosa A. Cunn.
torquata Luehmann.
amygdalina Labill.
radiata Sieber.
numerosa Maiden.
nitida Hook. f
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PART XXXIX.

Torelliana F.v.M.
corymbosa Smith.
intermedia R. T. Baker.
patellaris F.v.M.
celastroides Turczaninow.
gracilis F.v.M.
transcontinentalis Maiden.
longicornis F.v.M.
oleosa F.v.M.
Flocktoniæ Maiden.
virgata Sieber.
oreades R. T. Baker.
obtusiflora DC.
fraxinoides Deane and Maiden.
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217. *E. dichromophloia* F.v.M.
218. *E. pyrophora* Benth.
219. *E. lævopinea* R. T. Baker.
220. *E. ligustrina* DC.
221. *E. stricta* Sieber.
222. *E. grandis* (Hill) Maiden.
Plates, 164-167. (Issued March, 1920.)

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224. *E. Foelscheana* F.v.M.
225. *E. Abergiana* F.v.M.
226. *E. pachyphylla* F.v.M.
114. *E. pyriformis* Turczaninow, var. *Kingsmilli* Maiden.
92. *E. Oldfieldii* F.v.M.
227. *E. Drummondii* Bentham.
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229. *E. peltata* Bentham.
230. *E. Watsoniana* F.v.M.
231. *E. trachyphloia* F.v.M.
232. *E. hybrida* Maiden.
233. *E. Kruseana* F.v.M.
234. *E. Dawsoni* R. T. Baker.
62. *E. polyanthemos* Schauer.
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236. *E. conica* Deane and Maiden.
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237. *E. calophylla* R.Br.
238. *E. hæmatoxylon Maiden.*
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240. *E. Mooreana* (W. V. Fitzgerald) Maiden.
241. *E. approximans* Maiden.
242. *E. Stowardi* Maiden.
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244. *E. ptychocarpa* F.v.M.
245. *E. similis* Maiden.
246. *E. lirata* (W. V. Fitzgerald) Maiden, n.sp.
247. *E. Baileyana* F.v.M.
248. *E. Lane-Poolei* Maiden.
249. *E. Ewartiana* Maiden.
250. *E. Bakeri* Maiden.
251. *E. Jacksoni* Maiden.
252. *E. eremophila* Maiden.
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254. *E. tetrodonta* F.v.M.
255. *E. odontocarpa* F.v.M.
17. *E. capitellata* Smith.
256. *E. Camfieldi* Maiden.
257. *E. Blaxlandi* Maiden and Cambage.
258. *E. Normantonensis* Maiden and Cambage
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260. *E. eudesmioides* F.v.M.
261. *E. Ebbanoensis* Maiden n.sp.
15. *E. Andrewsi* Maiden.
262. *E. angophoroides* R. T. Baker.
263. *E. Kybeanensis* Maiden & Cambage.
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70. *E. decipiens* Endl.
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266. *E. de Beuzevillei* Maiden.
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268. *E. Brownii* Maiden and Cambage.
269. *E. Cambageana* Maiden.
123. *E. miniata* A. Cunn.
E. Woollsiana R. T. Baker.
44. *E. odorata* Behr and Schlecht.
43. *E. hemiphloia* F.v.M., var. *microcarpa* Maiden.
42. *E. bicolor* A. Cunn.
270. *E. Pilligaensis* Maiden.
271. *E. Penrithensis* Maiden.
112. *E. micranthera* F.v.M.
272. *E. notabilis* Maiden.
273. *E. canaliculata* Maiden.
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274. *E. decorticans* sp. nov.
275. *E. Culleni* R. H. Cambage.
276. *E. Beyeri* R. T. Baker.
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277. *E. nova-anglica* Deane and Maiden.

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Natural afforestation.
Increment curves
The largest Australian trees.
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38. *E. leptophleba* F.v.M.
279. *E. Dalrympleana* Maiden.
280. *E. Hillii* Maiden.
217. *E. dichromophloia* F.v.M.

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282. *E. Jutsoni* Maiden.
283. *E. adjuncta* Maiden.
1. *E. pilularis* Sm., var. *pyriformis* Maiden.
284. *E. pumila* Cambage.
285. *E. rariflora* F. M. Bailey.
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2. Eucalyptus bark classifications.
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290. *E. unialata* Baker and Smith.
31. *E. Planchoniana* F.v.M.
21. *E. marginata* Sm.
291. *E. Irbyi* Baker and Smith.
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294. x *E. Bourlieri* Trabut.
295. x *E. Cordieri* Trabut.
296. x *E. gomphocornuta* Trabut.
297. x *E. jugalis* Naudin.
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317. *E. Houtmanni* Ettingshausen.
318. *E. Mitchelli* Ettingshausen.
319. *E. cretacea* Ettingshausen.
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321. *E. Oxleyana* Ettingshausen.
322. *E. scoliophylla* Ettingshausen.
323. *E. Warraghiana* Ettingshausen.
324. *E. praecoriacea* Deane.
325. *E. Hermani* Deane
326. *E. Howitti* Deane.
327. *E. Kitsoni* Deane.
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P.—*E. (?) angustifolia* Newberry.
Q.—*E. (?) nervosa* Newberry.
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333. *E. angusta* n.sp.
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